5. WASTE AREA GROUP 2 (REACTOR TECHNOLOGY COMPLEX)

The Reactor Technology Complex (RTC), formerly known as the Test Reactor Area (TRA), was established in the early 1950s to study the effects of radiation on materials, fuels, and equipment. To aid in this research, a number of facilities were constructed, including three major test reactors: the Materials Test Reactor (1952 to 1970), the Engineering Test Reactor (1957 to 1982), and the Advanced Test Reactor (1967 to present).

Some of the operations at these and other RTC facilities have resulted in releases of radioactive and inorganic contaminants. Consequently, the RTC was designated as Waste Area Group (WAG) 2 under a federal facility agreement and consent order (FFA/CO) (DOE-ID 1991a). The FFA/CO further divided WAG 2 into 13 operable units (OUs) that contain a total of 55 release sites. In 1997, however, all of these sites were rolled into OU 2-13 (DOE-ID 1997a). Three records of decision (RODs) have been prepared for WAG 2.

The first WAG 2 ROD—signed on December 3, 1991—addressed OU 2-10, which is the warm waste pond sediments (DOE-ID 1991b) at the RTC. That ROD resulted in an interim action of physical separation and chemical extraction to recover contaminants from the warm waste pond sediments followed by backfilling the warm waste pond.

In December 1992, a ROD was issued for the OU 2-12 TRA perched water system (DOE-ID 1992). It was determined that no remedial action was necessary for the deep perched water system to ensure protection of human health and the environment. That decision was based on the results of human-health and ecological-risk assessments that showed the conditions at the site do not pose unacceptable risks to human health or the environment with regard to current and future use of the Snake River Plain Aquifer (SRPA) beneath the RTC. Originally, the OU 2-12 remedial investigation identified 13 contaminants of concern (COCs): Am-241, Cs-137, Co-60, H-3, Sr-90, arsenic, beryllium, cadmium, chromium, cobalt, fluoride, lead, and manganese (Dames and Moore 1992). A key assumption for the no-action decision was that groundwater monitoring would be performed to verify that contaminant concentration trends follow those predicted by computer modeling. That key assumption was carried forward in the comprehensive remedial investigation/feasibility study (RI/FS) (DOE-ID 1997a) and the OU 2-13 ROD issued in December 1997 (DOE-ID 1997b). The objectives of the groundwater monitoring program were to verify contaminant concentration trends in the SRPA, as predicted by the computer models, and to evaluate the effect that discontinuing discharge to the warm waste pond has had on contaminant concentrations in the deep perched water system and the SRPA. Subsequent monitoring and trending of the data, as discussed in Subsection 5.2, has reduced the groundwater COC list to Co-60, H-3, Sr-90, and chromium (DOE-ID 2003).

In 1997, a comprehensive RI/FS was completed in order to ascertain the extent of, and risks from, contamination at the 55 OU 2-13 release sites and the SRPA (DOE-ID 1997a). Data obtained during the RI/FS showed that contaminant concentrations at eight of the sites presented unacceptable risks to human health and safety or the environment. The final ROD for OU 2-13 recommended remedial actions for four of those eight sites and limited action for the remaining four sites (DOE-ID 1997b). Remedial actions were initiated at the sites in 1999 and completed in 2000. Table 5-1 lists the eight release sites described in the ROD as posing unacceptable risks. The table also shows the COCs and cleanup goals for each site.

Table 5-1. COCs at WAG 2.

Site (Site Code)	COCs	Cleanup Goals[a,b]
Warm Waste Pond (TRA-03)	Ag-108m	0.39 pCi/g
	Cs-137	7.78 pCi/g
	Eu-152	99.9 pCi/g
Chemical Waste Pond (TRA-06)	Barium	926 mg/kg
	Manganese	146 mg/kg
	Mercury	0.47 mg/kg
	Zinc	43.3 mg/kg
Cold Waste Pond (TRA-08)	Arsenic	18.3 mg/kg
	Cs-137	23.3 pCi/g
Sewage Leach Ponds (TRA-13)	Mercury	0.94 mg/kg
	Zinc	86.6 mg/kg
	Ag-108m	0.58 pCi/g
	Cs-137	11.7 pCi/g
Soil surrounding Hot Waste Tanks at Building TRA-613 (TRA-15)[c]	Cs-137	23.3 pCi/g
Soil surrounding Tanks 1 and 2 at Building TRA-630 (TRA-19)[c]	Cs-137	23.3 pCi/g
Brass Cap Area (TRA-Y)[c]	Cs-137	23.3 pCi/g
Sewage Leach Pond Berm and Soil Contamination Area[d]	Cs-137	23.3 pCi/g

a. Final remediation goals are soil concentrations of COCs that would result in a cumulative excess cancer risk of 1 in 10,000 or a hazard index greater than 1 for the 100-year residential exposure scenario. These might vary during the actual cleanup, in recognition of natural background levels, as established in *Background Dose Equivalent Rates and Surficial Soil Metal and Radionuclide Concentrations for the Idaho National Engineering Laboratory* (Rood, Harris, and White 1996), and in recognition that cleanup within the acceptable risk range could be achieved with a different mix of the COCs than was assumed in establishing these final remediation goal values.
b. These final remediation goals were not relevant to the sites where the selected remedy was containment. The remedial action objectives will be met by installing a cover to the exposure pathway.
c. Limited-action site.

Based on the results of the comprehensive RI/FS (DOE-ID 1997a), the other 47 sites were identified as no-action sites, because they posed no unacceptable risks. For seven of the no-action sites, however, determinations were based on assumptions that no changes would occur to either land use or exposure routes. As specified in the OU 2-13 ROD (DOE-ID 1997b), land use will be reviewed for those seven sites, and an explanation of significant differences (ESD) (DOE-ID 2000a) requires that they have institutional controls.

The first five-year review report (DOE-ID 2003) identified several issues that warranted further investigation to ensure the continued effectiveness of the selected remedies. Those issues included the recurrence of diesel in Well PW-13, increasing Co-60 in Well PW-12, increasing Sr-90 in several perched-water wells, continued use of the RTC beyond the 2007 closure assumed in the pre-ROD model, and fluctuations in perched water chemistry.

Investigative activities to address the issues included fieldwork, modeling, and conceptual model research. The activities, documented in the response to the first five-year review report (DOE-ID 2005), showed that the identified issues do not affect the selected remedies. Recommendations to ensure continued protectiveness of the selected remedies were also included in the document.

Figure 5-1 shows the locations of the eight release sites at WAG 2 that required remediation. Table 5-2 provides a chronology of significant events at WAG 2.

5.1 Remedial Actions

5.1.1 Remedy Selection

Remedies were selected for the eight WAG 2 sites that were identified as posing unacceptable risks at the RTC. The remedy selection process in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601 et seq.) was used to identify and select the remedies for each site. The following subsections describe the selected remedies.

5.1.1.1 Warm Waste Pond (Site TRA-03). The selected remedy for Cells 1952 and 1957 of the warm waste pond was containment of the pond contents using an engineered cover that consists of several layers of geologic materials to reduce potential exposure to contaminated pond sediments by human and environmental receptors. Cell 1964 includes a riprap layer placed over the existing native soil cover to inhibit future intrusion or excavation and to increase the degree of permanence of the remedy. The remedy for the warm waste pond also includes institutional controls that will remain in place as long as hazards that make the site unsuitable for unrestricted release are present. Specifically, the institutional controls include long-term environmental monitoring, cover integrity monitoring and maintenance, surface water diversions, and administrative and physical access restrictions.

5.1.1.2 Chemical Waste Pond (Site TRA-06). The selected remedy for the chemical waste pond was containment with a native soil cover and institutional controls with possible excavation, treatment, and disposal. Pre-remediation sampling conducted in 1998 verified that the sediments in the chemical waste pond were not Resource Conservation and Recovery Act (RCRA)-characteristic hazardous waste. As such, excavation, treatment, and disposal were not required (DOE-ID 1998a). This remedy provided soil that is thick enough to effectively reduce the potential for human and/or biological intrusion or excavation into the contamination. The remedy for the chemical waste pond also includes institutional controls, as described above for the warm waste pond.

5.1.1.3 Cold Waste Pond (Site TRA-08). The selected alternative for the cold waste pond was excavation and disposal. Institutional controls were also prescribed for the cold waste pond and included controlling access and restricting land use to all but industrial activities for 100 years after the remedial action. The selected remedy addressed the principal risks posed from the pond by effectively removing the source of contamination, thereby eliminating the pathway by which a future receptor might be exposed.

5.1.1.4 Sewage Leach Ponds (Site TRA-13). The selected remedy for the sewage leach ponds was containment using a native soil cover. The remedy provided soil that is thick enough to effectively reduce the potential for intrusion or excavation into the contaminated area and provided shielding against exposure to radionuclide contamination. Before the soil cover was put in place, contaminated soil from the sewage leach pond berms was placed in the bottom of the ponds to consolidate the contaminated soil (see Subsection 5.1.1.8). The remedy for the sewage leach ponds also includes institutional controls, as described above for the warm waste pond.

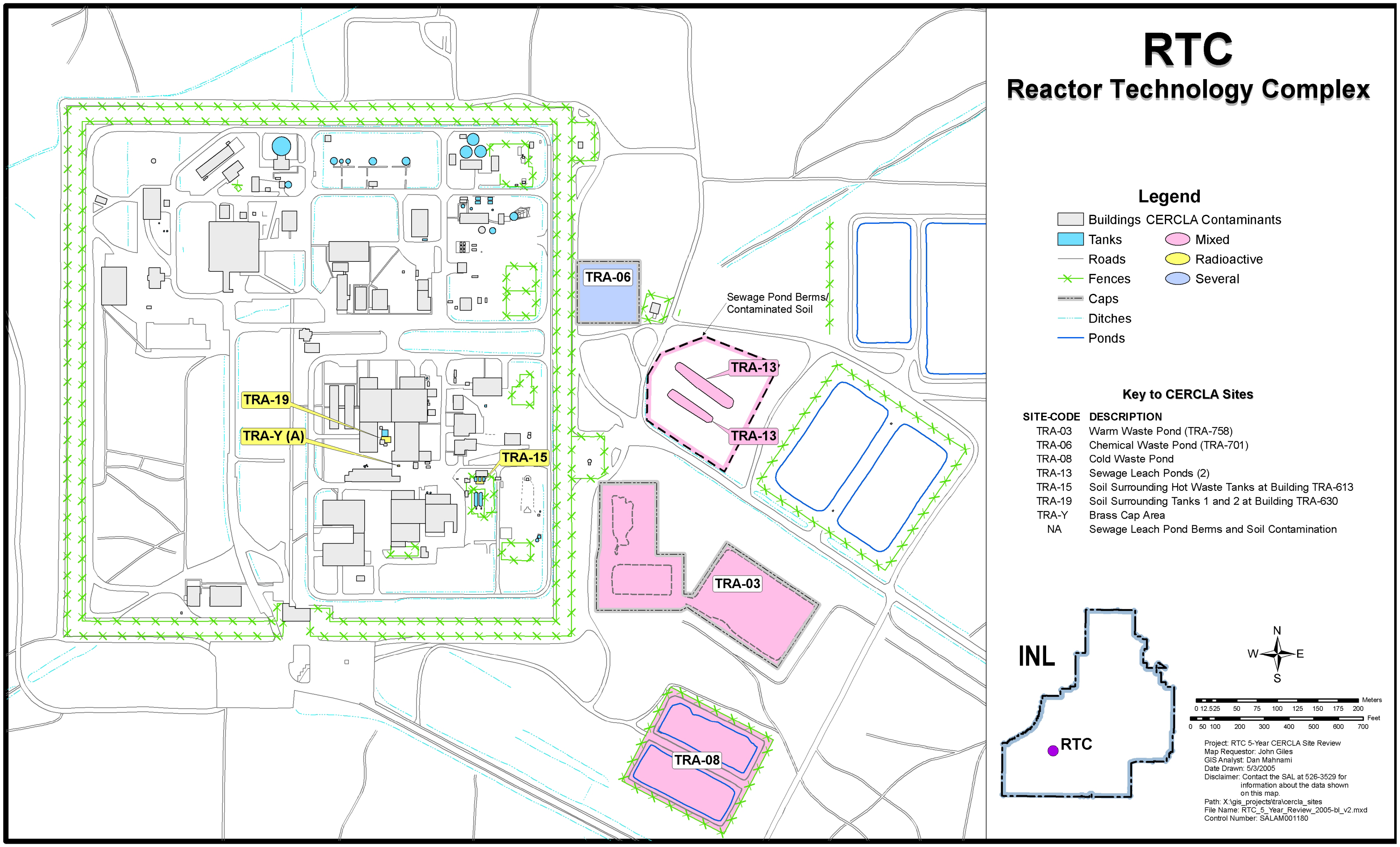


Figure 5-1. WAG 2 release sites that required remediation.

Table 5-2. Chronology of WAG 2 events.

Event	Date
The *Declaration for the Warm Waste Pond at the Test Reactor Area at the Idaho National Engineering Laboratory—Declaration of the Record of Decision* (DOE-ID 1991b) was signed.	December 1991
The OU 2-10 removal of windblown contamination at the warm waste pond was completed.	1992
The *Record of Decision, Test Reactor Area Perched Water System, Operable Unit 2-12, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho* (DOE-ID 1992) was signed.	December 1992
The *Explanation of Significant Differences for the Warm Waste Pond Sediments Record of Decision at the Test Reactor Area at the Idaho National Engineering Laboratory* (Jensen and Montgomery 1993) was issued.	March 1993
The *Post Record of Decision Monitoring Plan for the Test Reactor Area Perched Water System Operable Unit 2-12* (INEL 1993) was completed.	June 1993
The OU 2-10 warm waste pond interim action was completed.	December 1993
The OU 2-04 non-time-critical removal action at TRA-34 was completed.	1996
A three-year statutory review of the deep perched water system was completed.	August 1996
The *Comprehensive Remedial Investigation/Feasibility Study for the Test Reactor Area Operable Unit 2-13 at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 1997a) was completed.	February 1997
The *Final Record of Decision, Test Reactor Area, Operable Unit 2-13* (DOE-ID 1997b) was signed.	December 1997
The *Groundwater Monitoring Plan for the Test Reactor Area Operable Unit 2-13* (DOE-ID 1998b) was completed.	July 1998, revised 2004
The *Comprehensive Remedial Design/Remedial Action Work Plan for the Test Reactor Area, Operable Unit 2-13* (DOE-ID 1998a) was completed.	September 1998
The five-year statutory review of the warm waste pond interim action was completed.	September 1998
The actual remedial action began.	March 8, 1999
The comprehensive OU 2-13 remedial action was completed.	December 1999
The *Operations and Maintenance Plan for the Final Selected Remedies and Institutional Controls at Test Reactor Area, Operable Unit 2-13* (DOE-ID 2000b) was completed.	March 2000
The *Explanation of Significant Differences to the Record of Decision for Test Reactor Area Operable Unit 2-13* (DOE-ID 2000a) covering site-specific institutional controls was completed.	May 2000
The *First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2003) documented the first comprehensive remedy review for WAG 2.	September 2003

Table 5-2. (continued).

Event	Date
The *Project Close-out Report for Waste Area Group 2, Test Reactor Area* (INEEL 2003a) was completed.	September 2003
The *Response to the First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2005) was completed.	May 2005

5.1.1.5 Soil surrounding Hot Waste Tanks at Building TRA-613 (Site TRA-15). The selected remedy for the soil surrounding the hot waste tanks was limited action through the maintenance of institutional controls, including continued use of existing administrative controls and implementation of long-term environmental monitoring for at least 100 years. On the basis of radioactive decay, no further action is anticipated after 100 years.

5.1.1.6 Soil surrounding Tanks 1 and 2 at Building TRA-630 (Site TRA-19). The selected alternative for this site was limited action through maintenance of institutional controls. If the institutional controls are not maintained, a contingency for excavation and disposal exists for this site. But because of the physical location of the contaminated soil (i.e., subsurface soil in and around active radioactive waste piping and tank systems), access is limited, so removal of all of the contaminated soil in order to eliminate the need for institutional controls cannot be verified. Therefore, excavation alternatives cannot be fully implemented.

5.1.1.7 Brass Cap Area (Site TRA-Y). Like Site TRA-19, the selected alternative for the brass cap area was limited action through maintenance of institutional controls. If the institutional controls are not maintained, a contingency for excavation and disposal exists for this area. But because of the physical location of the contaminated soil (i.e., subsurface soil in and around active radioactive waste piping and tank systems), access is limited, so removal all of the contaminated soil to eliminate the need for institutional controls cannot be verified. Therefore, excavation alternatives cannot be fully implemented.

5.1.1.8 Sewage Leach Pond Berms and Soil Contamination Area. The selected alternative for the sewage leach pond berms and soil contamination area included placing the contaminated berm material in the bottom of the sewage leach pond before the native soil cover was placed over the pond (see Subsection 5.1.1 4). The remaining low-level, radionuclide-contaminated soil was left in place, and exposure to the contaminants is being minimized through the use of fences, signs, and monitoring.

5.1.1.9 Institutional Control Sites. After completion of the OU 2-13 comprehensive RI/FS (DOE-ID 1997a) and signing of the OU 2-13 ROD (DOE-ID 1997b), the 47 no-action sites were reevaluated, and 15 of those sites were found to require institutional controls to ensure adequate protection of human health and safety and the environment. The ESD to the OU 2-13 ROD discusses implementation, maintenance, and monitoring of institutional controls at each site in detail. A summary of the institutional controls identified for each of the WAG 2 sites is presented as follows:

- **Warm Waste Pond (Site TRA-03)—**Restrict the site to occupational access for more than 30 years, and restrict to industrial use until residential risk is < 1E-04 based on the results of a five-year review.
- **Warm Waste Retention Basin (Site TRA-04)—**Restrict the site to industrial land use only for depths less than 10 ft until approximately 2028. Restrict land use for deeper soil (approximately 40 ft), unless otherwise indicated based on the results of a five-year review.

- **TRA Chemical Waste Pond (Site TRA-06)—**Restrict residential land use to depths less than 14 ft.
- **TRA Cold Waste Disposal Ponds (Site TRA-08)—**Restrict the site to industrial land use for less than 100 years until residential risk is < 1E-04 based on the results of a five-year review.
- **TRA Sewage Leach Ponds (Site TRA-13)—**Restrict the site to occupational access for more than 30 years and restrict to industrial land use only until residential risk is < 1E-04 based on the results of a five-year review.
- **TRA Sewage Leach Pond Soil Contamination Area (Site TRA-13A)—**Restrict occupational and residential access until risk is 1E-04 based on results of a five-year review.
- **TRA Hot Waste Tanks 2, 3, 4 at TRA-613 (Site TRA-15)—**Restrict occupational residential access for less than 100 years until risk is 1E-04 based on the results of a five-year review. After the above restriction is removed, restrict land use at depths greater than 10 ft until otherwise evaluated.
- **TRA Rad Tanks 1 and 4 at TRA-630 (Site TRA-19)—**Restrict occupational access and prohibit residential development until soil is removed or status is changed based on results of a five-year review.
- **North Storage Area (Site TRA-34)—**Restrict the site to industrial land use only until residential risk is < 10^{-4} (until approximately 2028) based on the results of a five-year review.
- **Polychlorinated Biphenyl (PCB) Spill at TRA-619 (Site TRA-B)—**Permanently restrict the site to industrial land use only, unless otherwise indicated based on the results of a five-year review.
- **PCB Spill at TRA-626 (Site TRA-C)—**Permanently restrict the site to industrial land use only, unless otherwise indicated based on the results of a five-year review.
- **PCB Spill at TRA-653 (Site TRA-E)—**Permanently restrict the site to industrial land use only, unless otherwise indicated based on the results of a five-year review.
- **Hot Tree Site (Site TRA-X)—**Restrict the site to industrial land use only until approximately 2028 or until residential risk is < 10^{-4} based on the results of a five-year review.
- **Brass Cap Area (Site TRA-Y)—**Restrict occupational access and prohibit residential development until contamination is removed or status is changed based on a five-year review.
- **Perched Water and SRPA (No Action with Monitoring)—**Restrict drilling of wells for the purpose of drinking water use until contaminant concentrations are below the maximum contaminant level (MCL) based on the results of a five-year review.

Table 5-3 provides a current list of the institutionally controlled sites at WAG 5, identifies the contaminants of concern, and the concentration for each, the release criteria, and the expected release date.

Table 5-3. Institutionally controlled sites at WAG 2.

Site	Contaminant	Concentration[a]	Analysis Date	Release Criteria	Release Date
TRA-03	Ag-108m	1.67 pCi/g (maximum)	Various dates	0.63 pCi/g	Indefinite
	Cs-137	26,700 pCi/g (maximum)		2.4 pCi/g	
	Eu-152	20,500 pCi/g (maximum)		1.8 pCi/g	
TRA-04	Sr-90	88 pCi/g (average at depth > 18 ft)	1991	2,100 pCi/g[b]	2259
	Co-60	135 pCi/g (average at depth > 18 ft)		1.6 pCi/g	
	Cs-137	1,150 pCi/g (average at depth > 18 ft)		2.4 pCi/g	
TRA-06	Barium	802 mg/kg (95% H-UCL)	April 1998	926 mg/kg	Indefinite
	Manganese	6.3 mg/kg (95% approximate gamma UCL)		146 mg/kg	
	Mercury	25.2 mg/kg (95% Chebyshev UCL)		0.47 mg/kg	
	Zinc	4.2 mg/kg (95% approximate gamma UCL)		43.3 mg/kg	
TRA-08	Arsenic	8.2 mg/kg (95% Student's t UCL)	July 1998	18.3 mg/kg	April 2075
	Cs-137	13.7 pCi/g (95% approximate gamma UCL)	September 1999	2.4 pCi/g	
TRA-13 soil contamination area	Mercury	4.7 mg/kg (maximum)	1995	0.94 mg/kg	Indefinite
	Zinc	795 mg/kg (maximum)		86.6 mg/kg	
	Ag-108m	0.39 pCi/g (95% approximate gamma UCL)		0.63 pCi/g	
	Cs-137	16.6 pCi/g (95% approximate gamma UCL)		2.4 pCi/g	
TRA-13 berms	Ag-108m	0.39 pCi/g (95% Student's t UCL)	1995	0.63 pCi/g	Indefinite
	Cs-137	19.0 pCi/g (95% Student's t UCL)		2.4 pCi/g	
TRA-15[a]	Cs-137	1,176 pCi/g (99% Chebyshev UCL)	June 1993	2.4 pCi/g	March 2262
TRA-19[a]	Co-60	8.33 pCi/g (maximum)	May 1985	1.6 pCi/g	December 2375
	Cs-134	3,330 pCi/g (maximum)		8.4 pCi/g	
	Cs-137	19,500 pCi/g (maximum)		2.4 pCi/g	
	Sr-90	833 pCi/g (maximum)		2,100 pCi/g[b]	
TRA-34	Ag-108m	0.34 pCi/g (maximum)	September 26, 1995	0.63 pCi/g	No longer required
	Cs-137	0.53 pCi/g (95% approximate gamma UCL)		2.4 pCi/g	
	Eu-152	0.95 pCi/g (95% Student's t UCL)		1.8 pCi/g	
TRA-B	PCBs	19.3 mg/kg (95% Student's t UCL)	November 1990	Not applicable	Indefinite
TRA-C	PCBs	5.5 mg/kg (95% approximate gamma UCL)	September 1990	Not applicable	Indefinite

Table 5-3. (continued).

Site	Contaminant	Concentration[a]	Analysis Date	Release Criteria	Release Date
TRA-E	PCBs	1.5 mg/kg (95% approximate gamma UCL)	September 1990	Not applicable	Indefinite
TRA-X	Cs-137	4.81 pCi/g (maximum)	May 17, 1995	2.4 pCi/g	July 2025
TRA-Y[a]	Co-60	8.33 pCi/g (maximum)	May 1985	1.6 pCi/g	December 2375
	Cs-134	3,330 pCi/g (maximum)		8.4 pCi/g	
	Cs-137	19,500 pCi/g (maximum)		2.4 pCi/g	
	Sr-90	833 pCi/g (maximum)		2,100 pCi/g[b]	
TRA Groundwater	Cr	193 mg/kg (unfiltered- maximum)[c]	March 2005	0.1 mg/kg	To be determined
		132 mg/kg (filtered - maximum)		100 pCi/L	
	Co-60	36.8 pCi/L (maximum)[d]		8 pCi/L	
	Sr-90	88.9 pCi/L (maximum)[d]		20,000 pCi/L	
	H-3	24,000 pCi/L (maximum)[e]			

a. In accordance with the OU 2-13 ROD, this site will be evaluated following the decontamination and dismantlement of the surrounding RTC facilities.
b. Based on the new slope factors provided by the EPA guidance, the criteria to release the site for Sr-90 and its daughters is 23.1 pCi/g.
c. Maximum concentration obtained for a sample collected from aquifer Well TRA-07 during the March 2005 semi-annual sampling event. Historic results may be higher.
d. Maximum concentration obtained for a sample collected from perched Well PW-12 during the March 2005 semi-annual sampling event. Historic results may be higher.
e. Maximum concentration obtained for a sample collected from perched Well PW-11 during the March 2005 semi-annual sampling event. Historic results may be higher.

UCL = upper confidence limit

5.1.2 Remedial Action Objectives

Remedial action objectives (RAOs) for the eight sites of concern were developed in accordance with 40 *Code of Federal Regulations* (CFR) 300, "National Oil and Hazardous Substances Pollution Contingency Plan," and CERCLA RI/FS guidance through meetings with the Idaho Department of Environmental Quality, the U.S. Environmental Protection Agency (EPA), and the U.S. Department of Energy. The RAOs result from risk assessments and are specific to the COCs and exposure pathways developed for each site.

The RAOs for protection of human health and safety are as follows:

- Inhibit direct exposure to radionuclide COCs in soil that would result in a total excess cancer risk of greater than 1 in 10,000 to 1,000,000 (1E-04 to 1E-06) to current and future workers and future residents.
- Inhibit ingestion of chemical and radionuclide COCs in soil by all affected exposure routes (including ingestion of soil, groundwater, and homegrown produce) that would result in a total excess cancer risk of greater than 1 in 10,000 to 1,000,000 (1E-04 to 1E-06) or a hazard index greater than 1 to current and future workers and future residents.
- Inhibit the degradation of any low-level waste repository covers (e.g., warm waste pond cell covers) that would result in exposure to either the buried waste or the migration of contaminants to the surface and pose a total excess cancer risk (for all contaminants) of greater than 1 in 10,000 to 1,000,000 (1E-04 to 1E-06) or a hazard index greater than 1 to current and future workers and future residents.

The RAOs for protection of the environment are as follows:

- Inhibit adverse effects to resident populations of flora and fauna, as determined by the ecological risk evaluation from soil, surface water, or air containing COCs.
- Inhibit adverse effects at sites where COCs remain in place, which could result in exposure to COCs or migration of COCs to the surface.

To meet these RAOs, final remediation goals (Table 5-1) were established as quantitative cleanup levels and are based on the results of the baseline risk assessment and an evaluation of expected exposures and risks for selected alternatives. Remedial actions were completed to ensure that risks would be mitigated and exposure would not exceed the final remediation objectives.

5.1.3 Remedy Implementation

The following paragraphs describe the remedial actions implemented at the OU 2-13 sites of concern. More details about the remedial actions are found in the *Remedial Action Report for the Test Reactor Area Operable Unit 2-13* (DOE-ID 2000c). In addition to the eight sites identified for remedial action and limited action, the seven sites identified for no-action with institutional controls were also included in the OU 2-13 remedy implementation and are discussed in Subsection 5.1.1.9.

5.1.3.1 Warm Waste Pond (Site TRA-03). Remedial activities were conducted at the warm waste pond in 1999. Engineered soil covers were placed over the covers that were constructed during interim actions. Cell 1964 was covered with native soil, and Cell 1952 was covered with pea gravel, cobble, and a second layer of pea gravel. After radiologically contaminated soil from the north cold waste pond was placed in Cell 1957, it was covered with soil, pea gravel, cobble, and another layer of pea gravel. All three cells were then covered by a 2-ft-thick riprap layer to inhibit human intrusion. Pre-remediation occupational and residential risks are contained at this site beneath the engineered cover. Institutional controls were also established, thereby restricting the site to all but occupational access for more than 30 years and restricting the site to all but industrial land use until residential risk is < 10^{-04} based on the results of a five-year review.

5.1.3.2 Chemical Waste Pond (Site TRA-06). Remedial activities were conducted at the chemical waste pond in 1999. A three-layer, native-soil cover was constructed over the former waste pond and consisted of (1) a gravel and coarse-sand layer, (2) a compacted, low-permeability layer, and (3) a topsoil layer. The topsoil layer was reseeded with native vegetation to control erosion. Institutional controls were established, restricting residential land use to depths < 14 ft, where a mercury hazard remains. Industrial land use is unrestricted. Recently available EPA information could be used to reevaluate and increase the original OU 2-13 ROD's conservative final remediation goal for mercury. (See the *End of Well Report for MIDDLE-1823 Waste Area Group 10 Deep Corehole Vertical Profile* [INEEL 2003b] for an example of where a reevaluation was done.)

5.1.3.3 Cold Waste Pond (Site TRA-08). The cold waste pond remains in use today. The presence of Cs-137 is believed to be from windblown soil contamination originating from the warm waste pond, and the presence of arsenic is the result of historical disposal practices at the cold waste pond. Post-ROD sampling data (DOE-ID 1998c) confirmed that the pond sediments are below the 18.3-mg/kg final remediation goal for arsenic and the RCRA toxicity characteristic leaching procedure's regulatory limit. Therefore, arsenic was eliminated as a COC, and the final remediation goal for Cs-137 was increased from 11.7 to 23.3 pCi/g (DOE-ID 2000c). Remedial actions were conducted at the cold waste pond in 1999. Approximately 80 yd^3 of Cs-137-contaminated soil was removed from the northern ponds and transported to Cell 1957 of the warm waste pond for disposal. Institutional controls were established, thereby restricting the site to all but industrial land use until residential risk is < 10^{-04} based on the results of a five-year review.

5.1.3.4 Sewage Leach Ponds (Site TRA-13). Remedial actions were conducted at the sewage leach ponds in 1999. Approximately 1,431 yd^3 of soil contaminated with Cs-137 concentrations greater than 23.3 pCi/g was excavated from the sewage leach pond berms and placed in the bottom of the sewage leach pond. A three-layer native soil cover with a minimum thickness of 10 ft was then constructed over the ponds. The cover consisted of (1) a gravel and coarse-sand layer, (2) a compacted, low-permeability layer, and (3) a topsoil layer. Six inches of clean soil was placed over the soil contamination area that surrounds the sewage leach pond. The topsoil layer and the soil contamination area were reseeded with native vegetation to control erosion. Institutional controls were established, restricting the site to all but occupational access for more than 30 years and to all but industrial land use until residential risk is < 10^{-04}.

5.1.3.5 Soil Surrounding Hot Waste Tanks at Building TRA-613 (Site TRA-15). Occupational access is restricted at this site for 25 more years, and residential access is restricted for approximately 95 more years until the risk is < 10^{-04} based on the results of a five-year review. After the aforementioned restriction is removed, land use will be restricted at depths > 10 ft until otherwise evaluated.

5.1.3.6 Soil Surrounding Tanks 1 and 2 at Building TRA-630 (Site TRA-19). Occupational access is restricted and residential development is prohibited for at least 95 more years until soil is removed or the status is changed based on the results of a five-year review.

5.1.3.7 Brass Cap Area (Site Code TRA-Y). Occupational access is restricted and residential development is prohibited for at least 95 more years until soil is removed or the status is changed based on the results of a five-year review.

5.1.3.8 Sewage Leach Pond Berms and Soil Contamination Area. Remedial actions for the sewage leach pond berms and soil contamination area were conducted in conjunction with the sewage leach pond. For additional details see Subsection 5.1.3.4.

5.2 Data Evaluation

Site inspections were conducted annually for each site discussed in this section, as required by the OU 2-13 ROD (DOE-ID 1997b). The inspections were implemented through the *Operations and Maintenance Plan for the Final Selected Remedies and Institutional Controls at Test Reactor Area, Operable Unit 2-13* (DOE-ID 2000b), and the inspections were documented in annual inspection reports. A summary of the annual site inspections for the years 2003 and 2004 is included in this data evaluation.

Additionally, groundwater monitoring under CERCLA has been ongoing at the RTC per the requirements of the OU 2-12 and OU 2-13 RODs (DOE-ID 1992; DOE-ID 1997b). On October 7, 1991, the EPA designated the SRPA a sole-source aquifer under the Safe Drinking Water Act (42 USC § 300 et seq.). Although the SRPA and perched water beneath the RTC are listed as no-action sites, they are monitored extensively, because changes in these sites may be indicative of the effectiveness of the remedies in place at the OU 2-13 sites or may indicate the occurrence of a new release.

Under the *Groundwater Monitoring Plan for the Test Reactor Area Operable Unit 2-13* (DOE-ID 2004), perched-water and aquifer wells are routinely sampled for the COCs chromium, tritium, Co-60, and Sr-90. Previously, perched-water and aquifer wells were sampled for the radiological contaminants Am-241, Cs-137, Co-60, Sr-90, H-3, and the inorganic contaminants arsenic, beryllium, cadmium, chromium, fluoride, lead, manganese, and mercury. Water quality results show little impact (most levels near detection limits) for Am-241, Cs-137, arsenic, beryllium, cadmium, fluoride, lead, manganese, and mercury. In addition to sampling for contaminants, water levels are also collected from monitoring wells located near the RTC as part of routine monitoring activities. The United States Geological Survey (USGS) also monitors selected wells at the RTC, and data from the monitoring are used to supplement information collected under CERCLA-driven monitoring.

5.2.1 Site Inspections

Annual site inspections included visual inspections of the engineered soil covers, vegetation, and rip-rap covers. Radiological surveys were also performed on the warm waste pond and sewage leach pond covers and on the sewage leach pond soil contamination area to ascertain the extent, if any, of contaminant migration.

Visual site inspections showed that the engineered covers are functioning as designed, and the covers show no sign of erosion or animal intrusion; however, the vegetation on the chemical leach pond, the sewage leach ponds, and the sewage leach pond soil contamination area was sparse. The results from the annual radiological surveys indicate that the remedies at the warm waste pond and sewage leach pond are functioning as intended, with no unexplained radiological anomalies.

A review of the institutional controls indicated that they, too, are functioning as intended. Based on previous risk evaluations, institutional controls will need to be maintained until at least 2025, at which time they should be reevaluated.

5.2.2 Perched Water Data

The post-ROD monitoring plan (Dames & Moore 1993) specified that groundwater sampling and analysis for all COCs would be performed quarterly for six deep perched water wells (i.e., PW-11, PW-12, USGS-053, USGS-054, USGS-055, and USGS-056). The USGS has been collecting groundwater samples from wells near the RTC since the 1960s, but the USGS sampling has varied over the years in terms of wells, analytes, and frequency. Data from RTC area wells sampled by the USGS—but not required under the OU 2-13 groundwater monitoring plan (DOE-ID 2004)—were included in this five-year review. Figure 5-2 shows the locations of these and other perched-water and aquifer wells near the RTC. Table 5-4 lists the wells whose data was reviewed for this five-year review.

5.2.2.1 Perched Water Hydrogeologic Data Evaluation. Two perched water zones resulting from discharges of water to RTC ponds have been recognized. Historically, the cold waste pond has been the largest source of water for the perched water zones. From 1998 to 2004, the cold waste pond received an average of about 380 gal of water per minute. In the past, other surface sources of water, including the former warm waste pond and the chemical waste pond, represented only a small percentage of the total input to the subsurface. The history of liquid effluent discharge to ponds from 1982 through 2004 is summarized in Figure 5-3.

A strong correlation exists between water level patterns in the perched water system and the discharge rates to the cold waste pond. The thickness and size of the two perched water zones have changed over time, depending on the amount of water discharged to the RTC ponds. The relationship between pond discharge and the footprint of the perched water bodies has been tracked and described in numerous reports (Hull 1989; Doornbos et al. 1991; Dames & Moore 1992).

The shallow perched water zone is formed on a layer of fine-grained sediments at the alluvial-basalt contact at a depth of about 50 ft below land surface. The primary source of water for the perched water system, the cold waste pond, receives only relatively uncontaminated effluent. The shallow perched water eventually percolates through the underlying basalt to a deeper perched water zone. Consequently, the data evaluation focuses on the deep perched water.

The deep perched water zone can be seen to range in elevation from less than 4,750 ft to more than 4,860 ft. It is elongated in a northwest-to-southeast direction and generally has a broad, flat top with steeply sloping flanks (Figure 5-4). On the most recent contour map, the deep perched zone is narrower, and the elevations range from less than 4,730 ft to more than 4,850 ft. The deep perched zone still has a flat top with steeply dipping sides, but the highest elevation is centered beneath the cold waste pond. The hydrographs of most wells tapping the deep perched zone have shown a marked decrease in water elevation over the same period of March 1991 to April 2003. This is likely attributed to the decreased discharge to the ponds between 1991 and 2003. Although it is not apparent from Figure 5-3, the average discharge rate to the cold waste pond between early 1982 and late 1991 was 460 gal per minute. Since late 1991, discharges to the cold waste pond have averaged 380 gal per minute. It is important to note that the apex of the deep perched zone is now centered beneath the cold waste pond, where formerly it had been larger, extending to the northwest beneath the old warm waste pond and the RTC facility.

5.2.2.2 Deep Perched Water Analytical Data Evaluation. Most of the wells in the deep perched water system show fluctuating or decreasing trends in COC concentrations over the sampling record. The following paragraphs discuss the major COCs in the perched water zone. Perched water data are compared to MCLs in the following paragraphs; however, this comparison is not intended to convey that the perched water represents an aquifer capable of sustained long-term use.

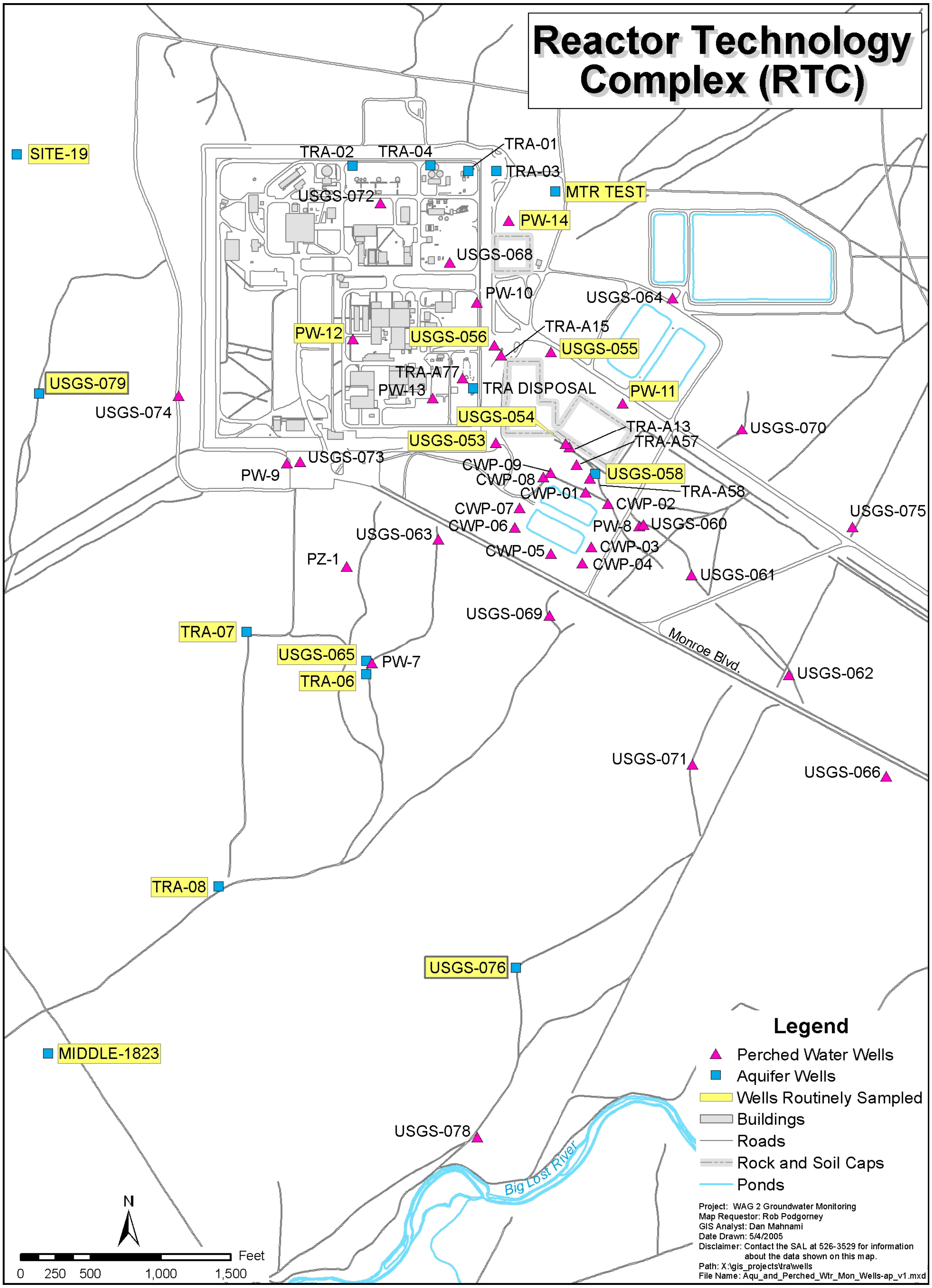


Figure 5-2. Map of monitoring wells at the RTC.

Table 5-4. Monitoring wells reviewed for this five-year review.

Shallow Perched Wells			
CWP-01	CWP-02	CWP-03	CWP-04
CWP-05	CWP-06	CWP-07	CWP-08
CWP-09	TRA-A13	TRA-A77	
Deep Perched Wells			
PW-07	PW-08	PW-09	PW-10
PW-11[a]	PW-12[a]	PW-13	PW-14[a]
USGS-053[a]	USGS-054[a]	USGS-055[a]	USGS-056[a]
USGS-060	USGS-061	USGS-062	USGS-063
USGS-64	USGS-066	USGS-068	USGS-069
USGS-070	USGS-071	USGS-072	USGS-073
USGS-074	USGS-075[a]	USGS-078	TRA-1933[a]
TRA-1934[a]			
Aquifer Wells			
MTR-TEST	SITE-19	TRA-DISP	TRA-01
TRA-02	TRA-03	TRA-04	TRA-06A[a]
TRA-07[a]	TRA-08[a]	USGS-058[a]	USGS-065[a]
USGS-076	USGS-079	USGS-084	Highway-3[a]
Middle-1823[a]			

a. Well identified in the OU 2-13 groundwater monitoring plan (DOE-ID 2004).

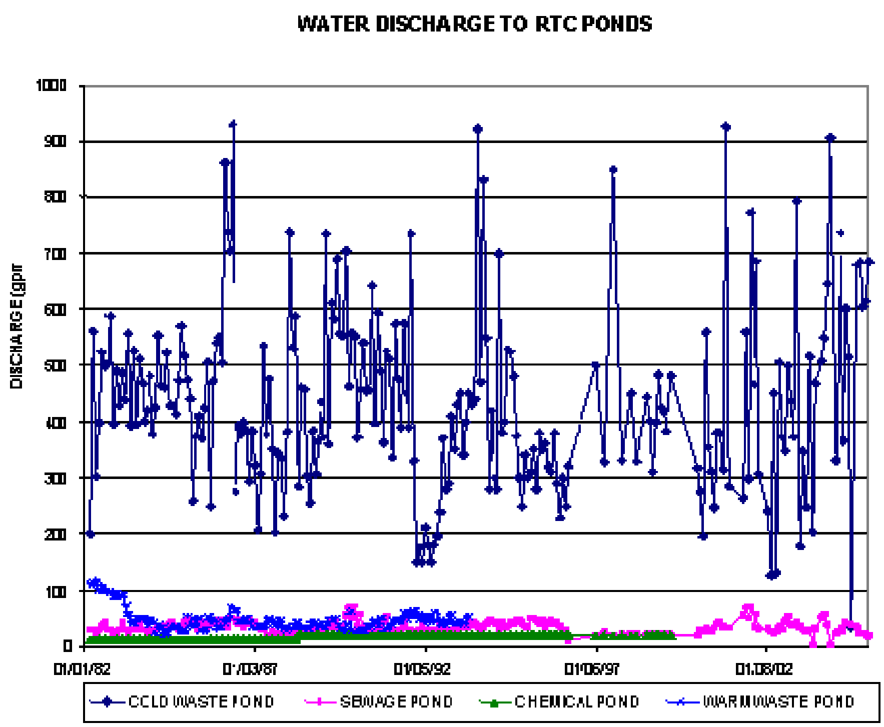


Figure 5-3. Historical discharges of water to the RTC ponds.

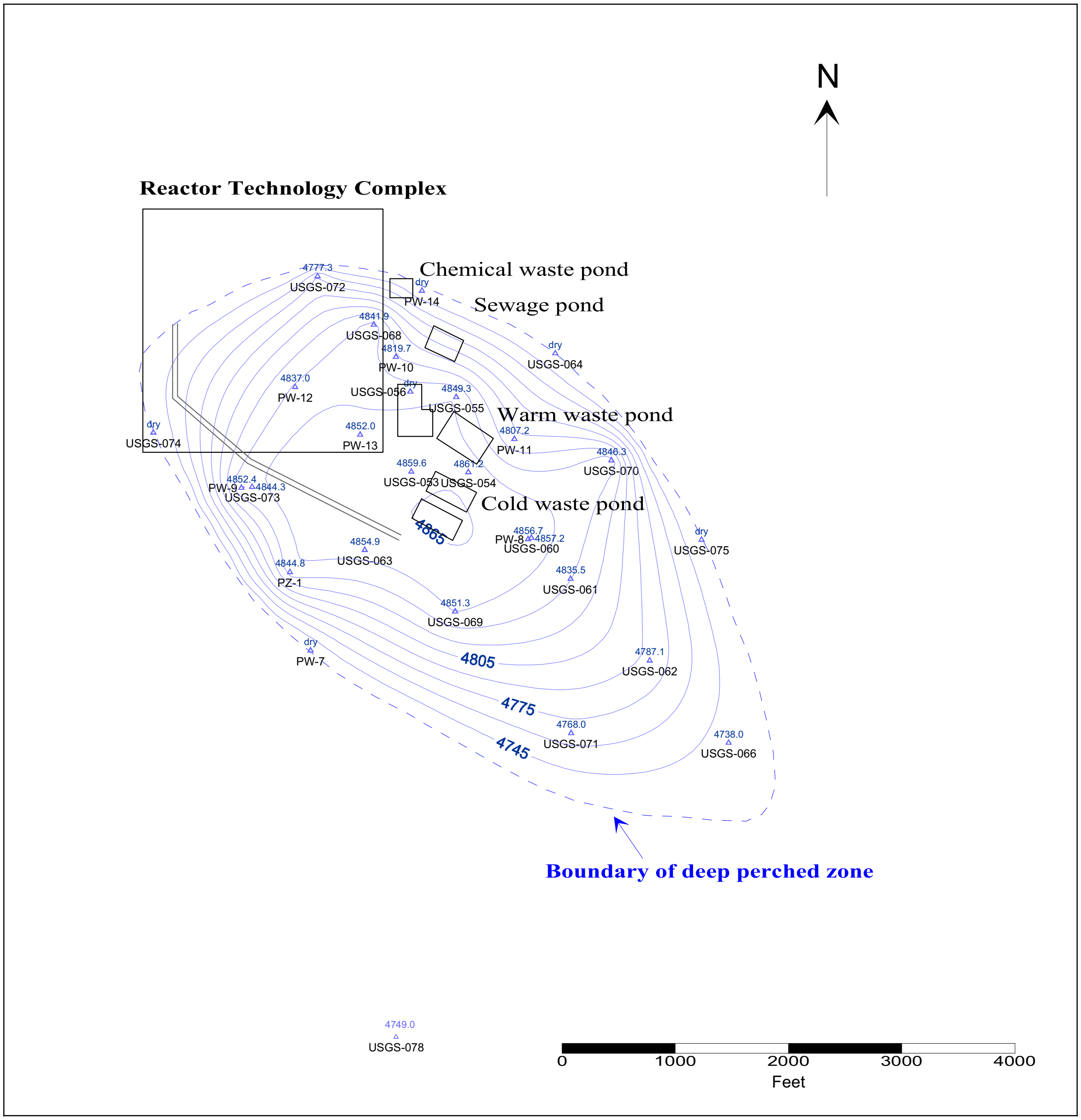


Figure 5-4. Configuration of the deep perched water at the RTC (November 2003).

The federal drinking water standard for chromium (total chromium) is 100 µg/L. Drinking water standards are based on unfiltered concentrations; however, differences in well construction and pumping rates make it difficult to evaluate concentrations of metals when the metals are present as particulate matter and in a dissolved state. In the hexavalent form, chromium is present in an anionic state (CrO_4^{2-}) and is relatively mobile in groundwater. Unfiltered samples might contain metals present as particulate matter, while filtered samples are representative of the more mobile dissolved metals. Filtered samples might also contain some colloidal particles fine enough to pass through the filter. Filtered and unfilteredsamples were collected for chromium and other metals from many of the wells. In general, filtered samples provide the best indication of groundwater contamination levels for chromium. Unfiltered samples are influenced by variability in the degree of well development and are subject to greater variability introduced by the sampling process.

Generally, chromium data show decreasing or flat concentration trends in most of the deep perched water wells. The highest concentrations have occurred in wells proximal to the warm waste pond, as shown in Figure 5-5. Those wells had reported values as high as 800 µg/L during the 1993 to 1995 period. Filtered sample results have not exceeded the MCL (100 µg/L) since 2001 (Figure 5-5). The concentration data in Well USGS-053 show a break in the data record from approximately 1996 to 2003, because that well has been dry sporadically in recent years. The lining of the evaporation pond and the resultant decrease in infiltration might have caused the drying, because the well is to the southwest of the warm waste pond. The spike in chromium concentrations in USGS-053 in 1995 does not have a clear explanation, but recent concentrations are well below MCLs.

The MCL for tritium is 20,000 pCi/L, and it has a half-life of 12.3 years. Tritium, as an isotope of hydrogen, travels with groundwater and is considered an ideal conservative tracer. Reductions in the activity of measured tritium can result from both dilution and radioactive decay.

Activities of tritium measured in deep perched wells proximal and distal to the warm waste pond versus time are shown in Figures 5-6 and 5-7, respectively. All wells show a drastic decline in reported values for tritium since completion of the remedial actions (construction of the new evaporation pond). With source-term elimination, radioactive decay plays a significant role in decreasing activity. Without the addition of new tritium to the subsurface, it is unlikely that tritium activity will ever increase. Included in Figures 5-6 and 5-7 are detailed plots of recent tritium activities for proximal and distal wells to the warm waste pond, respectively. The plots show that tritium is currently above the MCL for a few wells, but activities have declined steadily for the past five years in most wells. Well USGS-055 (Figure 5-6) showed an increase in tritium in the last sample collected, but the tritium was still well below its MCL.

The MCL is 8 pCi/L for Sr-90, which has a half-life of 29 years. As indicated by its high soil-to-water distribution coefficients (Kd 24 mL/g), Sr-90 is less mobile in soil water than tritium (Dames & Moore 1993). Strontium is present primarily as a divalent cation, and thus it behaves much like dissolved calcium.

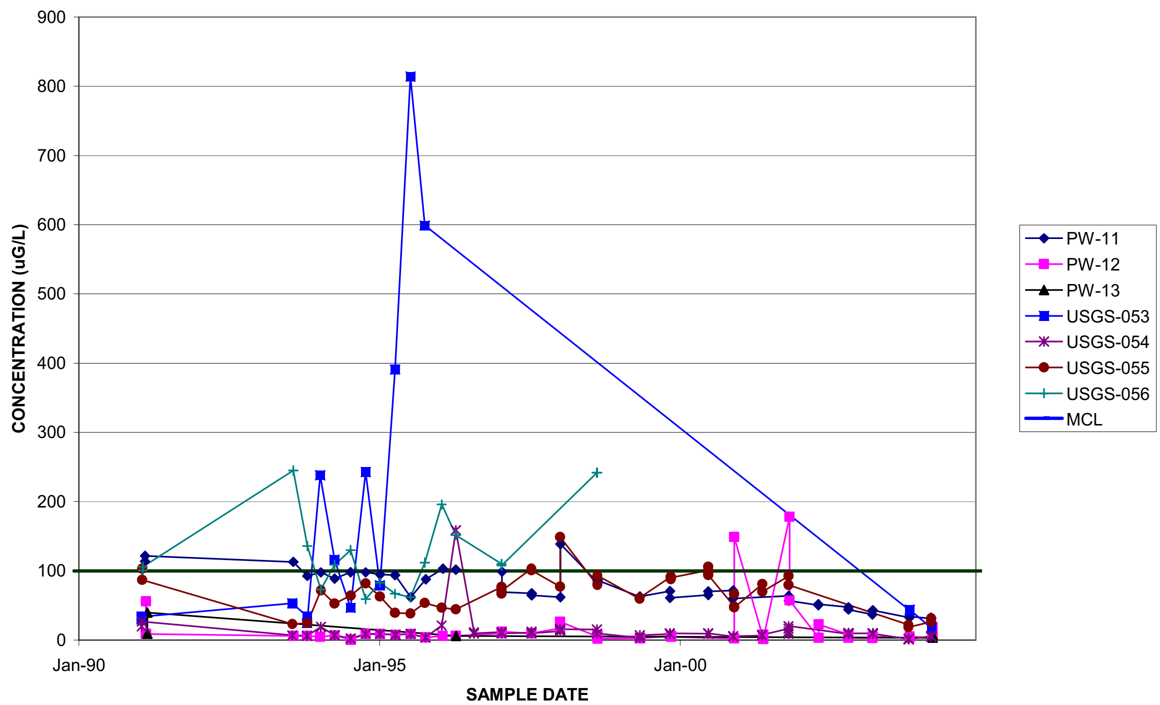
Figure 5-8 shows Sr-90 levels for wells proximal to the warm waste pond for the period of record. Activities for these wells peaked in the early 1970s. Figure 5-8 also shows a detail of Sr-90 activities for deep perched wells proximal to the warm waste pond over the past five years. While most of the wells shown on the graph have concentrations that are above MCLs, all wells show a general decreasing trend since the 2001 to 2002 timeframe.

For wells distal to the warm waste pond, only USGS-070 has consistently shown concentrations above MCLs. The most recent sampling conducted in the spring of 2004 reported values for Sr-90 of approximately 34 pCi/L. The general trend in Sr-90 concentrations is a steady decline in Well USGS-070 over the interval from 1996 to 2004.

The MCL is 100 pCi/L for Co-60, which has a half-life of 5.2 years. Co-60 is relatively immobile in groundwater, as indicated by its high soil-to-water distribution coefficient (Kd 56 mL/g) (Dames & Moore 1993).

In general, Co-60 levels in the perched water have historically shown decreasing trends, with the highest results in wells used to monitor the deep perched water proximal to the warm waste pond (Figure 5-9). In recent years, most of the Co-60 levels have been below the MCL. One notable exception to the general trends of decreasing or fluctuating concentrations in the past five years occurred at Well PW-12, which spiked to a value over 300 pCi/L in the spring of 2003. The concentration has steadily declined since the 2003 spike and was approximately 50 pCi/L in the sample collected during the spring 2004 sampling round.

WELLS PROXIMAL TO THE WARM WASTE POND- CHROMIUM



RECENT DATA FOR WELLS PROXIMAL TO THE WARM WASTE POND- CHROMIUM

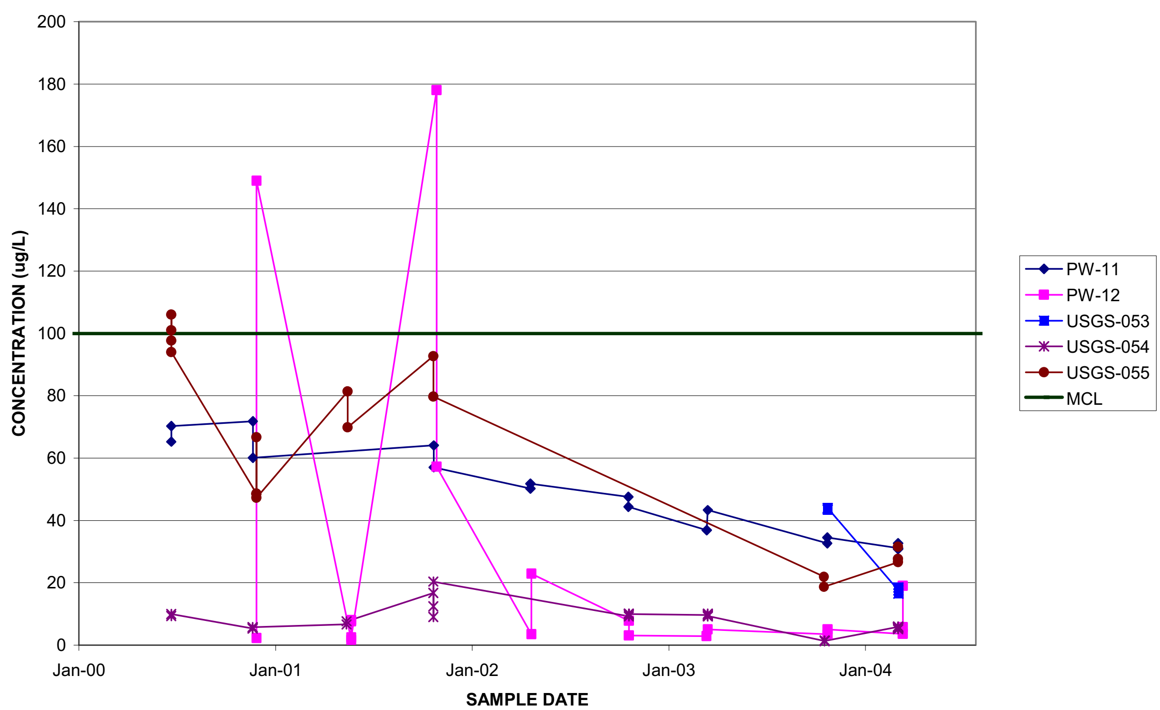
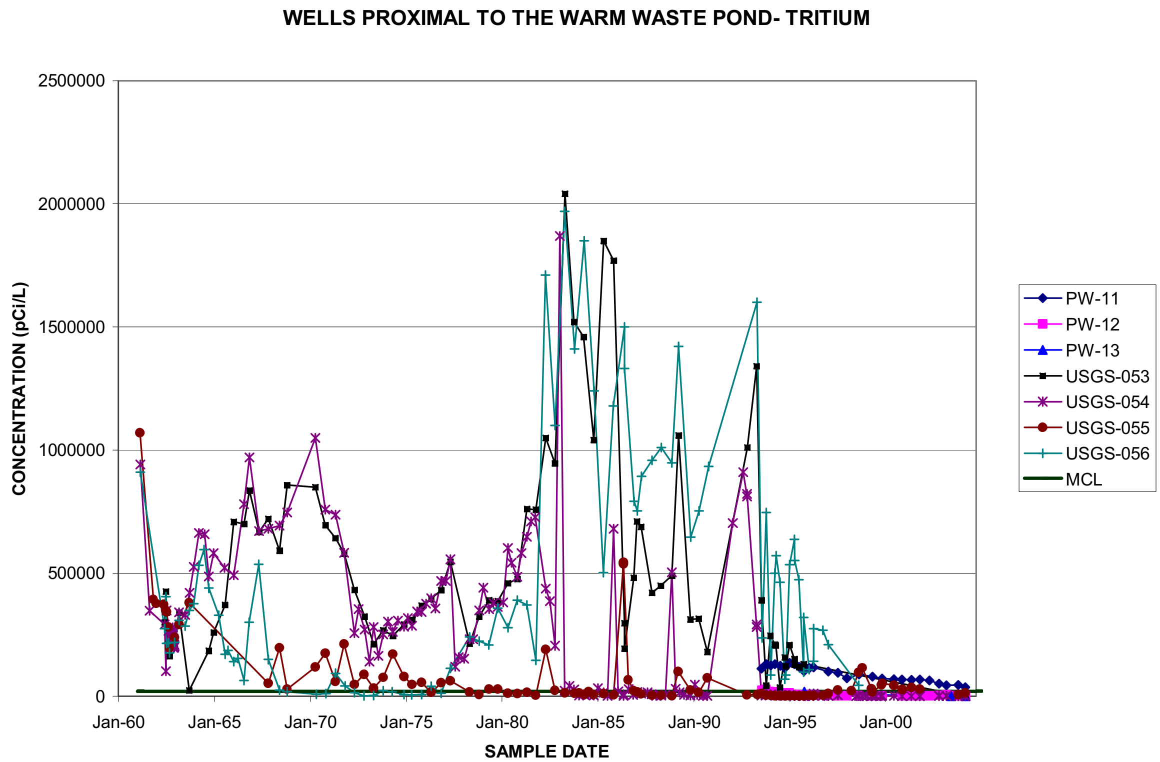


Figure 5-5. Chromium levels in wells proximal to the warm waste pond.



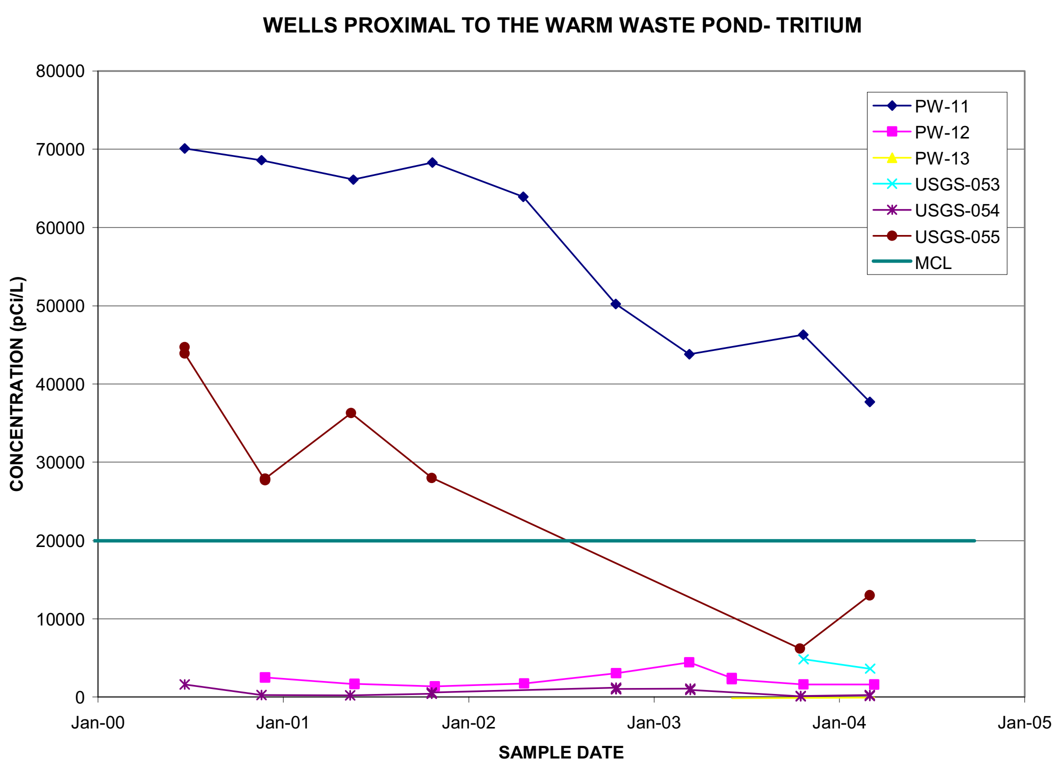
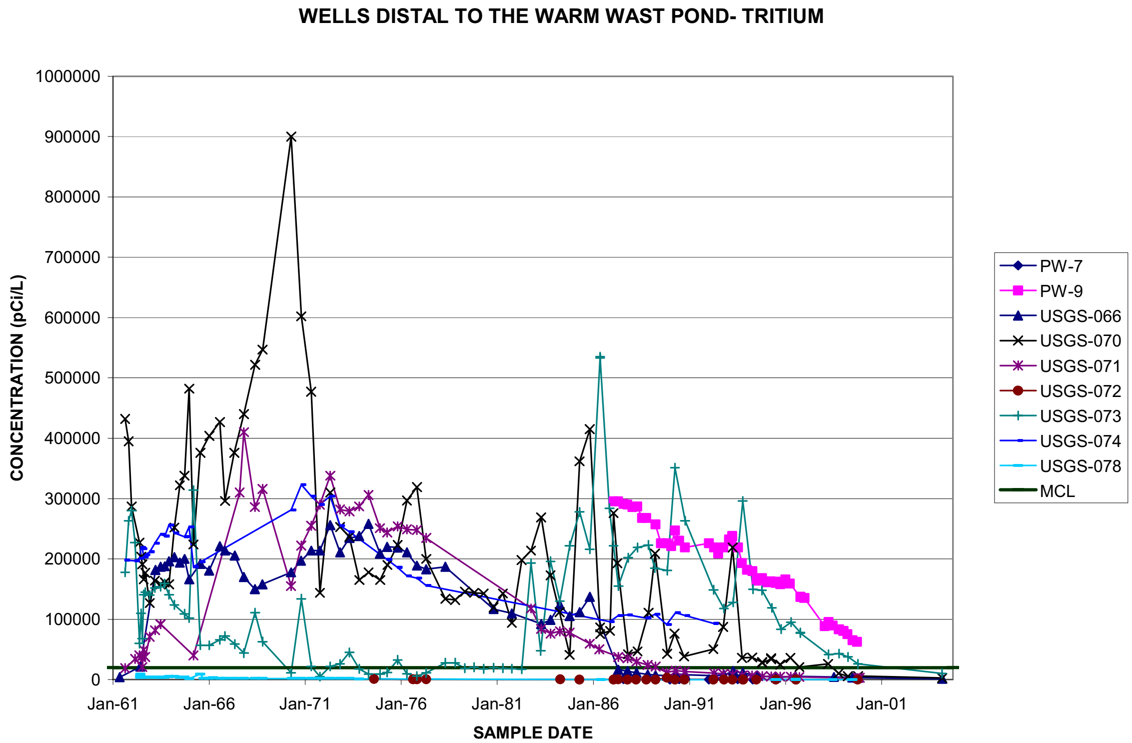


Figure 5-6. Tritium levels in wells proximal to the warm waste pond.



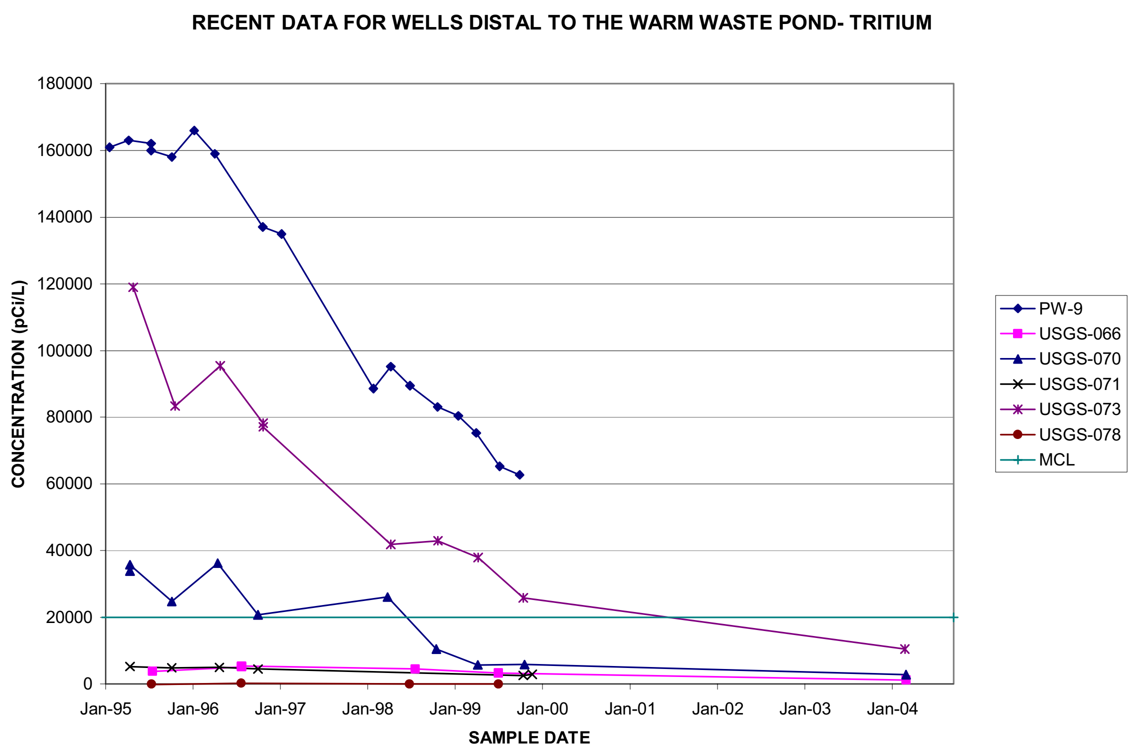
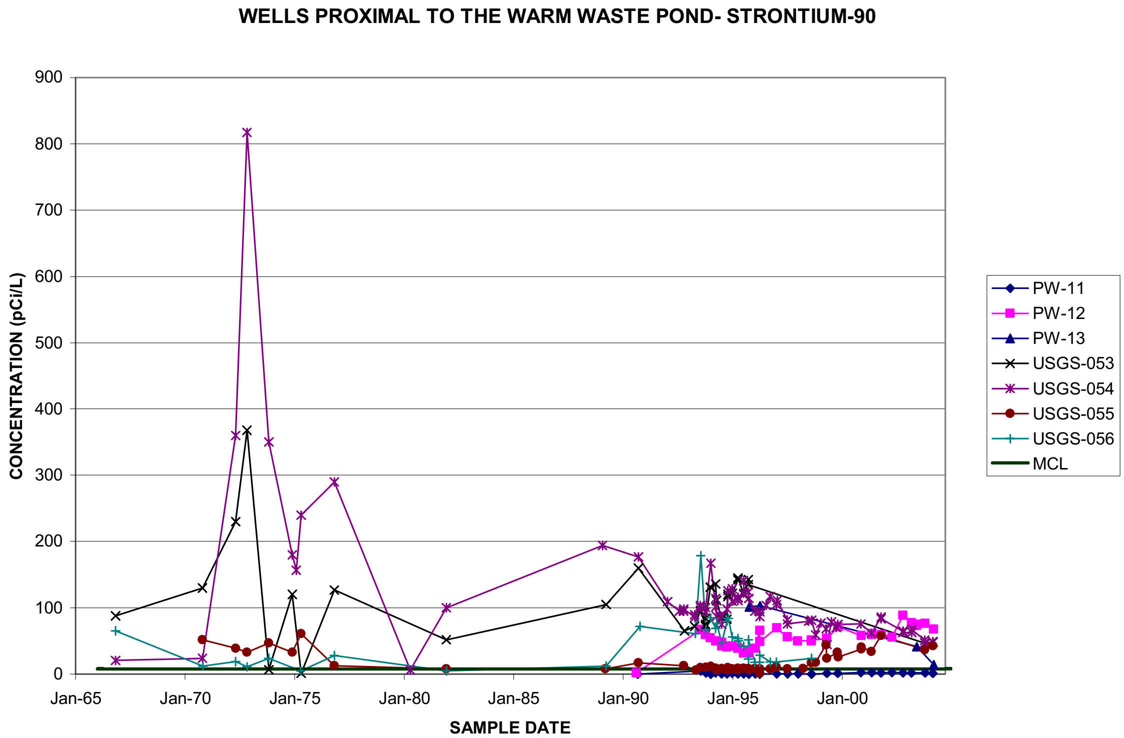


Figure 5-7. Tritium levels in wells distal to the warm waste pond.



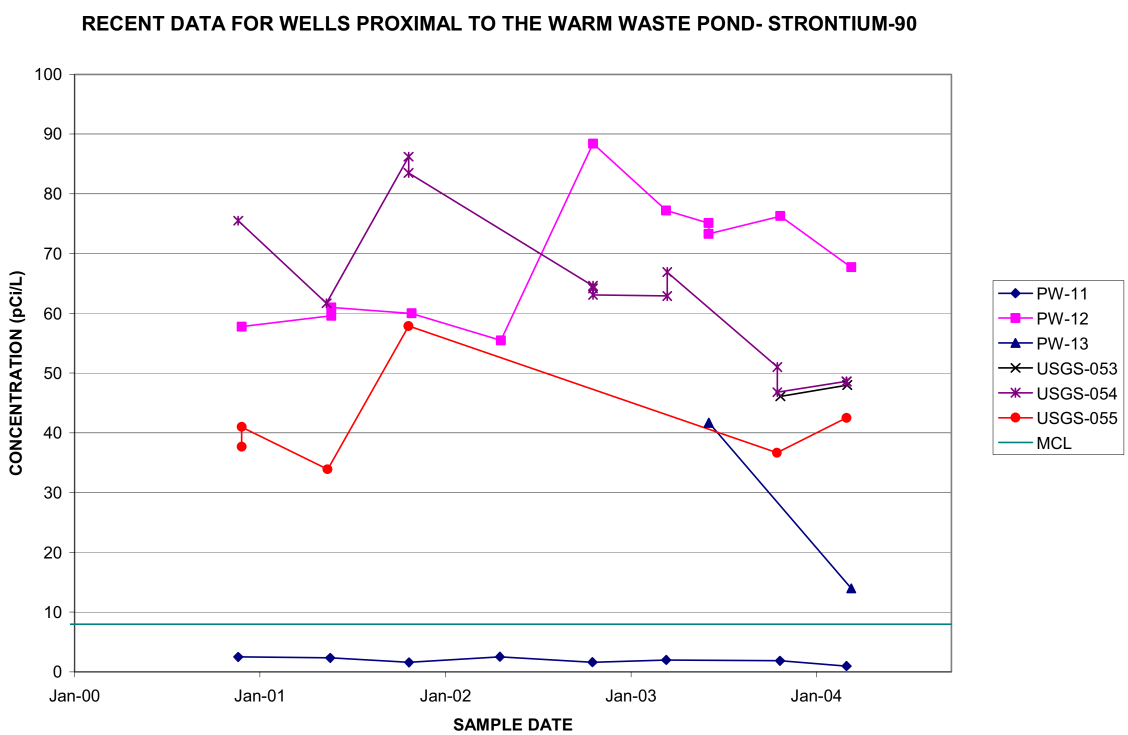
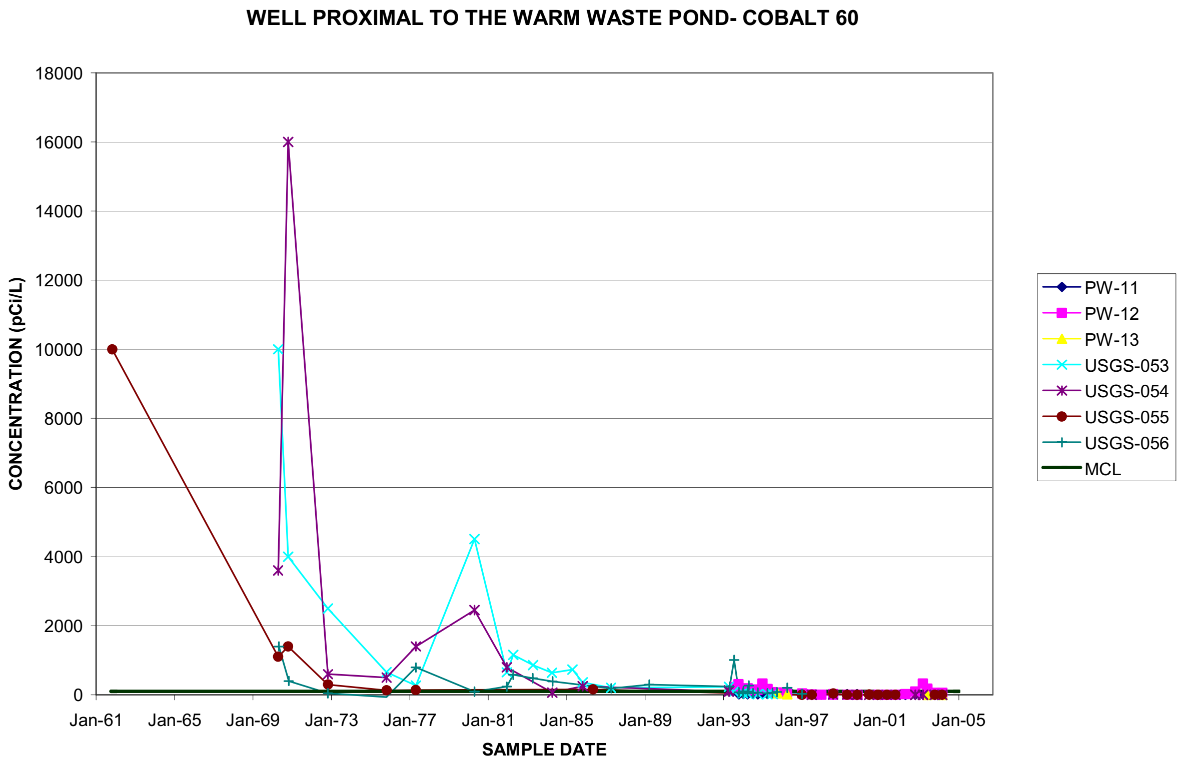


Figure 5-8. Sr-90 concentrations proximal to the warm waste pond and recent data for Sr-90 concentrations proximal to the warm waste pond.



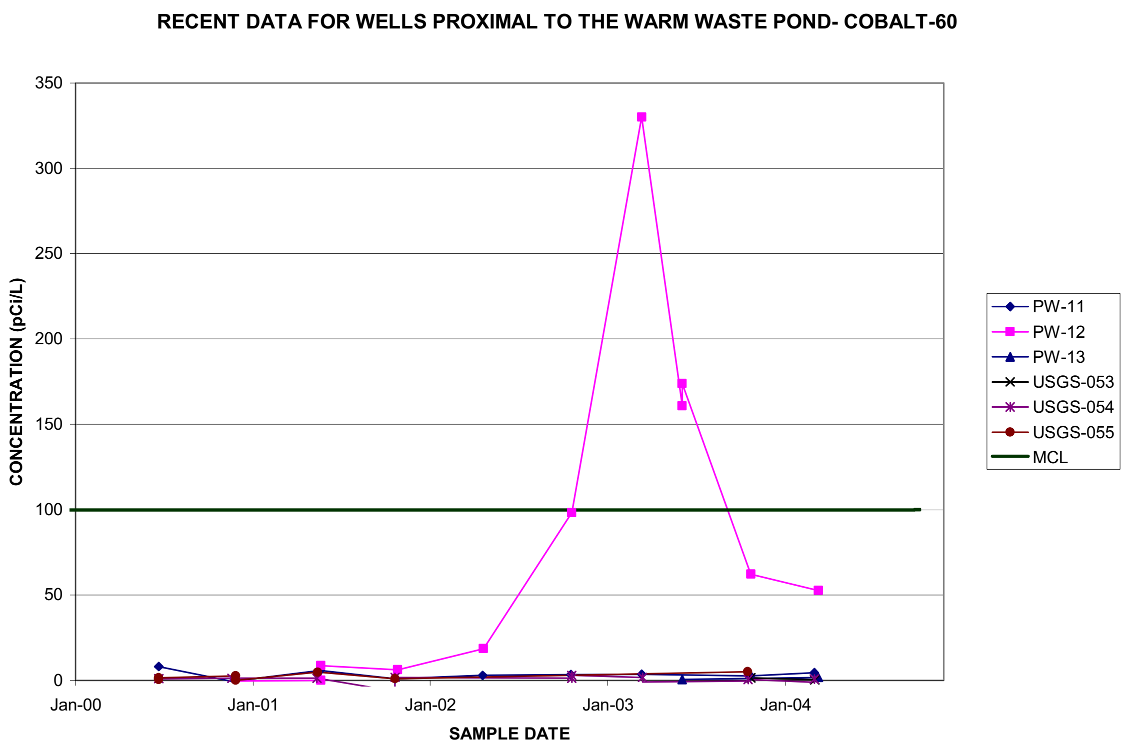


Figure 5-9. Historical Co-60 levels in perched water wells.

A detailed study of the Co-60 spike in PW-12 was conducted and documented in the *Response to the First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory* (DOE-ID 2005), which reported that the spike likely resulted from remobilization of existing Co-60 because of changes in hydrogeologic conditions. Continued monitoring per the OU 2-13 groundwater monitoring plan (DOE-ID 2004) was recommended in this well.

A layer of free-phase diesel product was discovered during the drilling of well PW-13 in 1990. Shortly after the installation of the well, a series of measurements was taken to determine the presence and thickness of the floating product. Since then, the well has been monitored intermittently, revealing a high degree of variability in product thickness. Between February 2003 when the last five-year review was completed at WAG 2 and September 30, 2004, product thickness measurements were taken in PW-13 on four occasions (ICP 2004). Product was encountered three of the four times and continues to show variability in the thickness. Figure 5-10 shows the product thickness over time in well PW-13. Additional discussion of free-phase product sampling at WAG 2 is presented in Appendix B.

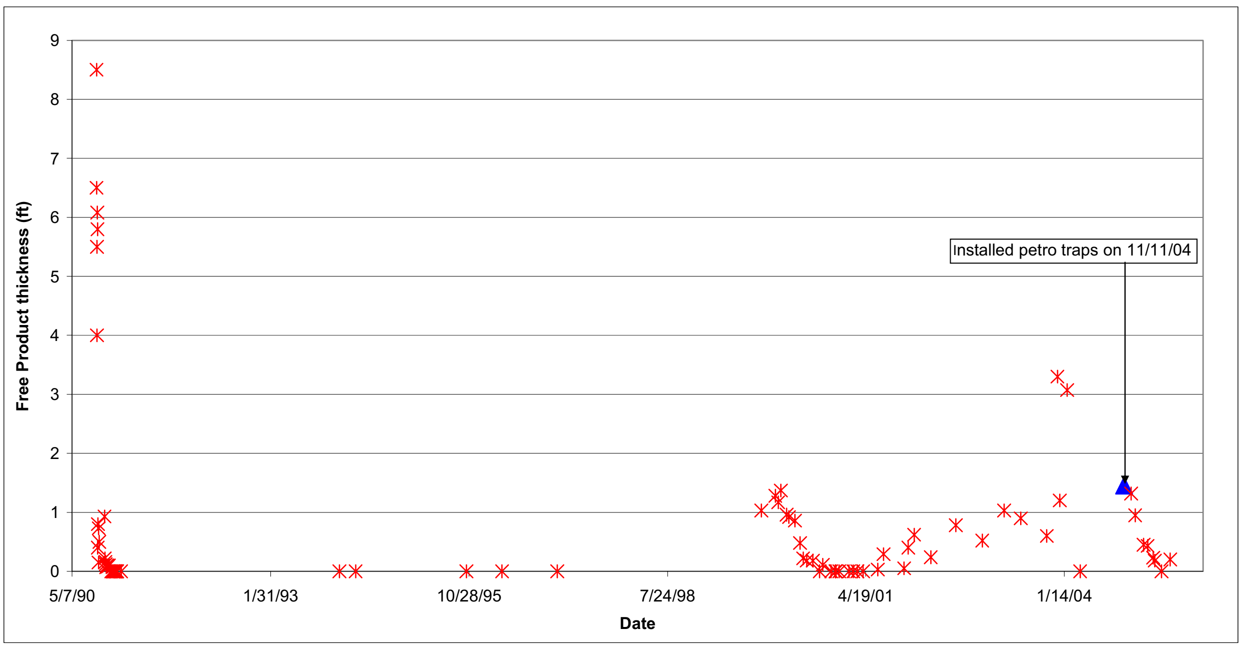


Figure 5-10. Free-phase product thickness over time in PW-13.

5.2.3 SRPA Data

Aquifer wells are currently sampled for the COCs chromium, tritium, Co-60, and Sr-90. Water level data are also collected from aquifer wells to evaluate groundwater flow directions.

5.2.3.1 SRPA Water Level Data Evaluation. The SRPA occurs approximately 450 ft below the RTC and consists of a series of saturated basalt flows and sedimentary materials. The SRPA is relatively permeable because of the presence of fractures, fissures, and rubble zones at contacts between individual basalt flows.

A groundwater elevation contour map was constructed for the SRPA under the RTC using data collected in June 2004 (Figure 5-11). Groundwater elevations were ascertained by subtracting depth-to-water measurements from surveyed elevation data plus the measured stick-up and then correcting for stretch and/or variations associated with the e-line tape and for borehole deviation in wells.

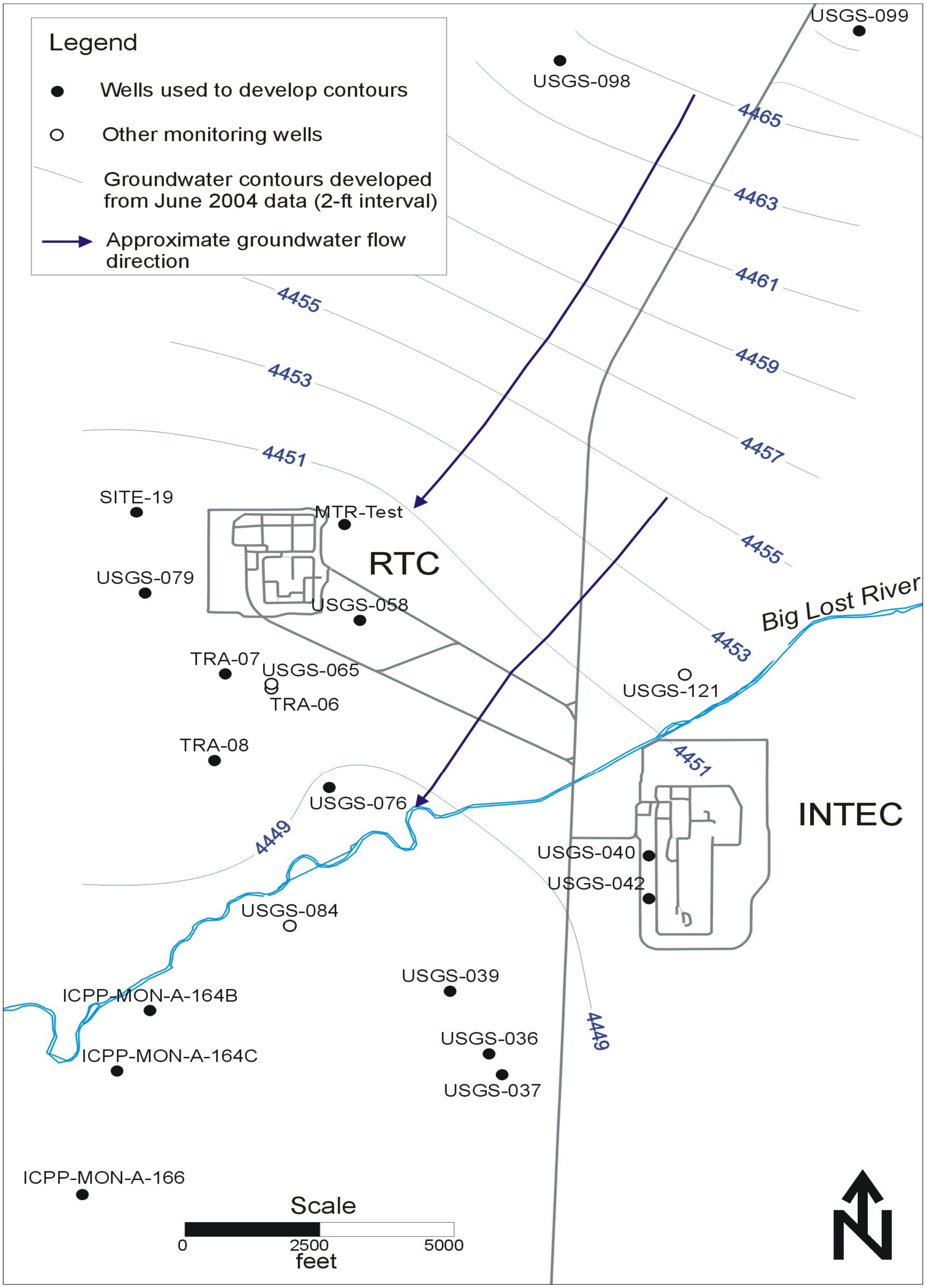


Figure 5-11. SRPA water table configuration for June 2004.

Generally, groundwater flows to the southwest under the ambient, hydraulic gradient. Figure 5-11 depicts the SRPA water table in June 2004. The inherent heterogeneity of the fractured basalt SRPA makes it difficult to contour the water table. Figure 5-11 also shows the inferred direction of groundwater flow beneath the RTC. The direction of flow is inferred, because the SRPA's highly heterogeneous matrix creates anisotropy that can result in flow paths not perpendicular to the water level contours. Fluctuating water levels caused by recharge and pumping further complicate a determination of SRPA flow directions in the general vicinity of the RTC. Therefore, uncertainty exists about the direction of groundwater flow in the vicinity of the RTC because of the heterogeneity and the spatial and temporal changes that occur within the SRPA. At this time, it appears that a portion of the RTC within the fence line is not covered by the existing monitoring well network in the SRPA. Additional monitoring wells do not appear to be needed immediately but may need to be considered in the future, depending on further evaluation of sources within the RTC fence line

5.2.3.2 Snake River Plain Aquifer Analytical Data Evaluation. Currently, groundwater samples are collected on a semiannual basis from aquifer water Wells TRA-06A, TRA-07, TRA-08, USGS-065, USGS-058, Middle-1823, and Highway-3. The samples are analyzed for chromium (filtered and unfiltered), Sr-90, gamma isotopes, and tritium. In addition to the usual analytes, aquifer wells were analyzed for I-129 and Tc-99 in the October 2003 sampling event, as agreed to in the previous five-year review report (DOE-ID 2003). I-129 and Tc-99 concentrations were below detection limits in all samples.

Chromium is the only analyte that is currently above an MCL in aquifer wells. As of March 2004, chromium is above its MCL (100 µg/L) in two wells, USGS-065 and TRA-07. Unfiltered chromium samples show a general declining trend for the three aquifer wells that are immediately downgradient of the RTC (Figure 5-12) and are much lower than model predictions. The TARGET computer code was used to simulate groundwater flow and transport in a two-dimensional model to characterize the flow and migration of contaminants between the warm and cold waste ponds and the SRPA (DOE-ID 2005). Chromium concentrations show a consistent decline in USGS-065 and TRA-07 since August 1999. The linear trend line for TRA-07 suggests that chromium concentrations in both USGS-065 and TRA-07 will drop below the MCL sometime near 2008 (Figure 5-13). The date predicted by the linear trend line to drop below the MCL is considerably sooner than the 2034 date predicted by the TARGET computer model.

All aquifer wells near the RTC were below the MCL (20,000 pCi/L) for tritium as of March 2004. Historically, TRA-07 and USGS-065 have been above the MCL. But since 1999, concentrations have dipped below the MCL for tritium (Figure 5-14). Most wells show declining or relatively flat trends for tritium with some associated variability between sampling rounds (Figure 5-14). Sr-90 was not detected in any of the aquifer wells in the RTC vicinity since the last five-year review.

5.2.4 Monitoring Results Summary

The primary COCs identified in SRPA wells are chromium and H-3, but only chromium exceeded an MCL. Measured concentrations of chromium in SRPA monitoring wells are decreasing and expected to reach the MCL sometime around 2008—considerably ahead of the model-predicted date of 2034. Tritium levels in all aquifer wells are below the MCL and expected to continue to decrease due to radioactive decay and dilution.

Most of the contaminants monitored in the deep perched water zone show decreasing concentration trends since the last five-year review. Most contaminants are also below MCLs in the deep perched water, with some notable exceptions discussed below. Filtered chromium concentrations are below MCLs in all deep perched water wells.

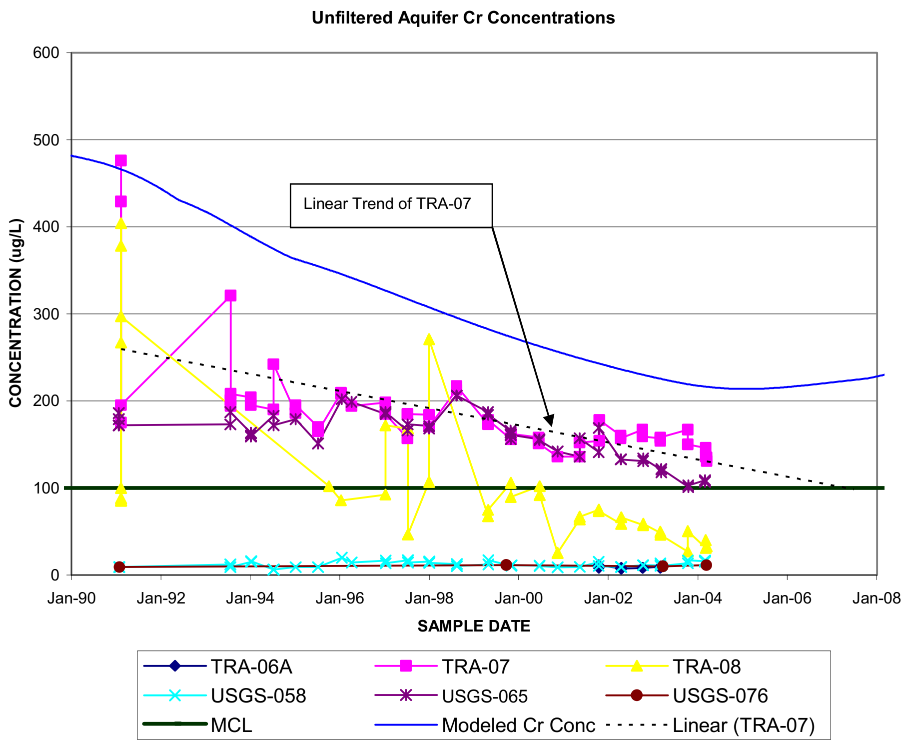


Figure 5-12. Unfiltered chromium concentrations compared to model predictions (1990 to present).

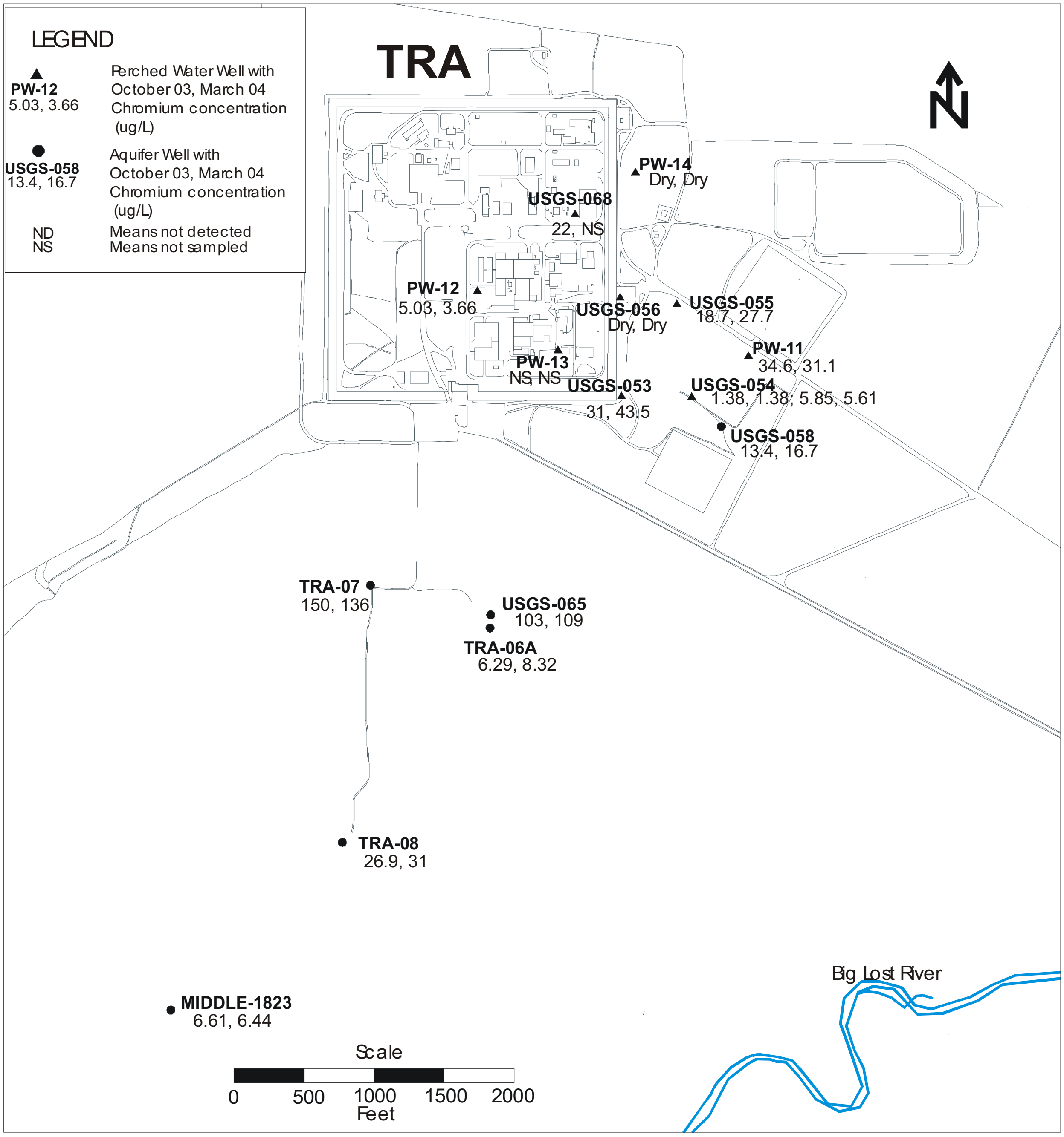


Figure 5-13. Chromium concentrations (µg/L) for October 2003 and March 2004.

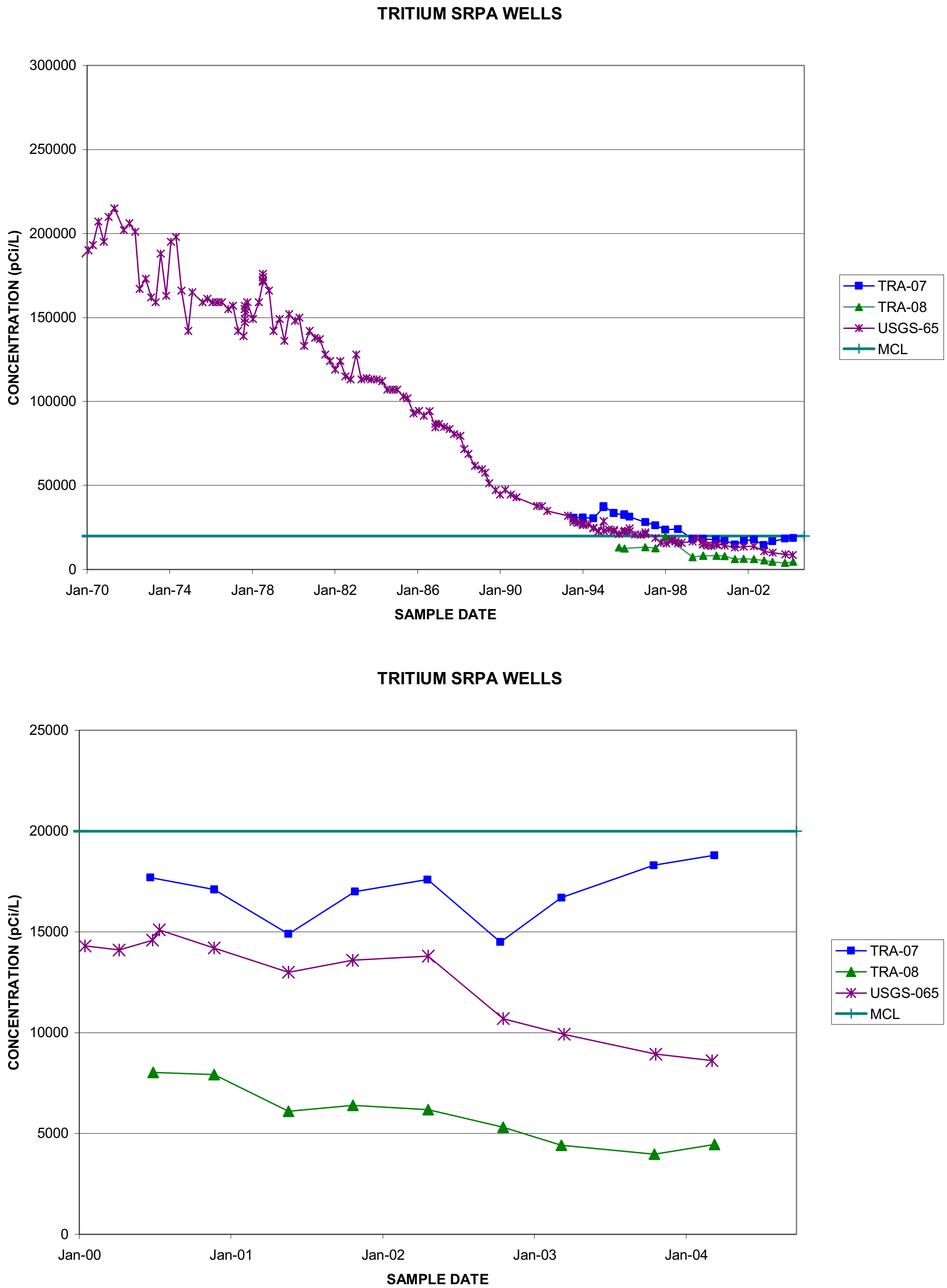


Figure 5-14. Tritium concentration in selected SRPA wells in the vicinity of the RTC for long-term trends and recent values.

Tritium values are below MCLs in all perched water wells except PW-11, which has been consistently above MCLs since the early 1990s. There is a significant and established decreasing trend in the concentrations, however, and if the current trend continues, the concentrations will drop below MCLs by 2007.

A number of perched wells have Sr-90 concentrations that are above MCLs. These wells include most of the deep perched wells proximal to the warm waste pond (PW-12, PW-13, USGS-053, USGS-054, and USGS-055) and one distal perched water well (USGS-070). The concentration trends in most of these wells have been relatively flat, with some variation between sampling events. Well USGS-070 has shown a decreasing trend since about late 1996.

Co-60 concentrations are currently below MCLs in all deep perched water wells. As previously discussed, a spike of Co-60 was detected in PW-12 in recent years, but the concentration has returned to a value below the MCLs in the last two sampling rounds conducted in the fall of 2003 and the spring of 2004. The spike was attributed to changing hydrologic conditions in the vicinity of the well.

5.3 Progress since Last Review

The following actions were completed in response to issues identified in the previous five-year review, with complete results detailed in the *Response to the First Five-Year Review Report for the Test Reactor Area, Operable Unit 2-13, at the Idaho National Engineering and Environmental Laboratory* (DOE 2005):

1. A systematic analysis was done to identify the source of increasing Co-60 and Sr-90 in the perched water. Potential sources of Co-60 near Well PW-12 were investigated, historical contaminant trends in perched water wells were evaluated, natural mechanisms that might create non-idealized behavior were assessed, and new research suggesting that non-ideal behavior might be a characteristic common to fractured rock vadose zones was examined. The analysis showed that the spike in Co-60 was probably due to changes in the rate of water infiltrating through residual contamination near PW-12.
2. The potential impacts of continued RTC operations on the perched water system and the assumptions used in the OU 2-13 ROD (DOE-ID 1997b) were evaluated. A water budget for the RTC was developed, the pre-ROD model with a new operational scenario was evaluated, and a new vadose flow and transport model using a commercially available, modern numerical simulator was developed (DOE-ID 2005). The updated flow modeling predicted that all of the concentrations of modeled contaminants in the SRPA would decrease below MCLs by approximately 2034.
3. The groundwater monitoring plan (DOE-ID 2004) was revised, and the number of analytes was reduced. One round of sampling also included I-129 and Tc-99.
4. A geochemical investigation was conducted to fingerprint various water sources at the RTC so that sources of water for perched water wells could be correlated. Additional samples of perched and aquifer water were collected, the distribution of contaminants in the perched water was examined to ascertain sources of contaminants, water sources were characterized based on major ion chemistry and oxygen and hydrogen isotope data to determine water sources, flow paths were examined using oxygen and hydrogen isotope data and major ion chemistry data, and information on contaminant sources and water sources was combined to characterize perched water bodies. The results of this investigation show that the perched water bodies below the RTC are from several distinct sources, most notably from the cold waste pond and leakage from underground water piping.

5. A field characterization effort was carried out to identify the extent and source of diesel in the PW-13 perched water well. Potential diesel sources were investigated, two new perched water wells were installed near PW-13, new wells and selected existing wells were sampled for dissolved constituents of diesel fuel, natural attenuation of diesel was evaluated, and natural mechanisms for "cycling" diesel in the subsurface were analyzed. The analysis showed that the recurrence of diesel is likely due to periodic trapping of the free-phase product in response to changes in the hydrologic conditions in the vicinity of Well PW-13 and that the selected remedy (i.e., no further action) remains protective. The study recommended continued monitoring of the free product thickness on a monthly basis. Petroleum traps have been installed in the three wells used for this investigation.

6. Vegetation at the chemical waste pond, the sewage leach pond, and the sewage leach pond soil contamination area continues to be monitored on an annual basis. The inspection conducted during fiscal year 2004 showed that the vegetation areas will require continued monitoring until native/planted flora is able to establish itself, as assessed during a five-year review.

5.4 Technical Assessment

The information provided in this technical assessment is based on previously compiled data regarding the operations, maintenance, and monitoring activities associated with Sites TRA-03, -06, -08, -13, -15, -19, and -Y.

5.4.1 Warm Waste Pond (Site TRA-03)

Question A: *Is the remedy functioning as intended by the decision documents?*

The RAO at the warm waste pond was to inhibit the exposure of human or ecological receptors to radiological contamination remaining in place and resulting in unacceptable excess risk. Based on the review of the inspections and monitoring that have been conducted in the two years following the first five-year review, the remedy at the warm waste pond is functioning as intended by the decision documents. The operations and maintenance activities and the institutional controls are effective in maintaining the functionality and integrity of the remedy.

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?*

There have been no changes to the original exposure assumptions, toxicity data, cleanup levels, or RAOs since completion of the remedial action. As such, the original assumptions are still considered valid.

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

5.4.2 Chemical Waste Pond (Site TRA-06)

Question A: *Is the remedy functioning as intended by the decision documents?*

The RAO at the chemical waste pond was to inhibit the exposure of human or ecological receptors to toxic metal contamination remaining in place and resulting in unacceptable excess risk. Based on the review of the inspections and monitoring that have been conducted in the two years following the first five-year review, the remedy at the chemical waste pond is functioning as intended by the decision documents. The operations and maintenance activities and the institutional controls are effective in maintaining the functionality and integrity of the remedy.

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?*

There have been no changes to the original exposure assumptions, toxicity data, cleanup levels or remedial action objectives since completion of the remedial action. As such, the original assumptions are still considered valid.

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

5.4.3 Cold Waste Pond (Site TRA-08)

As stated previously, the cold waste pond is still being used. Contaminated soils were removed from the cold waste pond and consolidated under the engineered cover at the warm waste pond in 1999. Institutional controls are in place at the cold waste pond, and it is restricted to industrial use only.

Question A: *Is the remedy functioning as intended by the decision documents?*

The removal of soils during the 1999 OU 2-13 remedial action reduced the excess unacceptable risk to levels commensurate with industrial-use scenarios. Contaminated soil was removed during the OU 2-13 remedial action. Institutional controls and operations and maintenance activities were established. Based on the inspections conducted annually at the site, the institutional controls and the operations and maintenance activities are effective in maintaining the remedy as intended by the decision documents.

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?*

There have been no changes to the original exposure assumptions, toxicity data, cleanup levels, or RAOs since completion of the remedial action. As such, the original assumptions are still considered valid.

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

5.4.4 Sewage Leach Pond and Sewage Leach Pond Soil Contamination (Site TRA-13)

Question A: *Is the remedy functioning as intended by the decision documents?*

Routine, annual radiological surveys conducted at the sewage leach pond remedial action site in 2003 and 2004 demonstrated that the radiation levels remain unchanged at the site and are consistent with the site background. Additionally, visual inspections of the site indicate that the institutional controls (i.e., signage and land use restrictions) have been effective in maintaining the protectiveness of the remedy. Based on these findings, the remedy is functioning as intended by the decision documents.

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?*

There have been no changes to the original exposure assumptions, toxicity data, cleanup levels, or RAOs since completion of the remedial action. As such, the original assumptions are still considered valid.

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

5.4.5 Limited Action Sites TRA-19 and -Y

Institutional controls have been implemented at sites TRA-19 and -Y with the contingency for excavation and disposal of contaminated media that present an unacceptable risk.

Question A: *Is the remedy functioning as intended by the decision documents?*

Annual inspections of the TRA-19 and -Y sites indicate that the institutional controls in place (i.e., signage and land use restrictions) are effective in maintaining the integrity of the sites and limiting exposure of human or ecological receptors to the contaminants remaining at these sites. As such, the contingency for excavation and disposal has not required implementation.

Question B: *Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives used at the time of the remedy selection still valid?*

There have been no changes to the original exposure assumptions, toxicity data, cleanup levels, or RAOs since completion of the remedial action. As such, the original assumptions are still considered valid.

Question C: *Has any other information come to light that could call into question the protectiveness of the remedy?*

No.

5.5 Technical Assessment Summary

5.5.1 Warm Waste Pond (Site TRA-03)

The warm waste pond was capped with an engineered cover, and institutional controls were put in place to ensure the protectiveness of the remedy. The technical assessment finds that the remedy and institutional controls are functioning as intended.

5.5.2 Chemical Waste Pond (Site TRA-06)

The chemical waste pond was capped with a soil cover and vegetated, and institutional controls were put in place to ensure the protectiveness of the remedy. With the exception of sparse vegetation growth, the technical assessment finds that the remedy and institutional controls are functioning as intended.

5.5.3 Cold Waste Pond (Site TRA-08)

The cold waste pond is an active site. The removal of contaminated soils and implementation of institutional controls provide protection for human health and safety and for the environment. The technical assessment finds the remedy and institutional controls are functioning as intended.

5.5.4 Sewage Leach Ponds (Site TRA-13)

The sewage leach ponds were capped with a soil cover and vegetated, and institutional controls were put in place to ensure the protectiveness of the remedy. With the exception of sparse vegetation growth, the technical assessment finds that the remedy and institutional controls are functioning as intended.

5.5.5 Soil Surrounding Hot Waste Tanks at Building TRA-613 (Site TRA-15)

Institutional controls have been implemented at Site TRA-15. The technical assessment finds that the no-action decision and underlying assumptions remain valid in the interest of protection of human health and safety and the environment.

5.5.6 Soil Surrounding Tanks 1 and 2 at Building TRA-630 (Site TRA-19)

Institutional controls have been implemented at Site TRA-19, with the contingency for excavation if the institutional controls are not maintained. The technical assessment finds that the underlying assumptions remain valid in the interest of protection of human health and safety and the environment.

5.5.7 Brass Cap Area (Site TRA-Y)

Institutional controls have been implemented at the brass cap area, with the contingency for excavation if the institutional controls are not maintained. The technical assessment finds that the underlying assumptions remain valid in the interest of protection of human health and safety and the environment.

5.5.8 Sewage Leach Pond Berms and Soil Contamination Area

The sewage leach pond berms and soil contamination area were included with the remedial action at the sewage leach ponds. As stated previously for the sewage leach ponds, the technical assessment finds that the remedy and institutional controls are functioning as intended.

5.5.9 Institutional Control Sites

Institutional controls have been implemented at the warm waste retention basin (Site TRA-04), the north storage area (Site TRA-34), the PCB spill at TRA-619 (Site TRA-B), the PCB spill at TRA-626 (Site TRA-C), the PCB spill at TRA-653 (Site TRA-E), the hot tree site (TRA-X), and the SRPA. The technical assessment finds that the no-action decisions and underlying assumptions remain valid in the interest of protection of human health and safety and the environment.

5.6 Issues

Establishment and maintenance of desirable vegetation on the native soil covers for the chemical waste pond, the sewage leach pond, and the sewage leach pond soil contamination area were identified as issues during this five-year review.

5.7 Recommendations and Follow-up Actions

Recommendations for the WAG 2 sites stem from the response actions to issues identified during the first five-year review. The following actions are recommended to ensure long-term protectiveness of human health and the environment for the selected remedies for OU 2-13 (DOE-ID 2005):

- Monitor selected perched water wells for dissolved diesel components at least annually until it is confirmed that the free product observed in Well PW-13 is either a new problem or the residual of an old diesel spill.
- Continue monthly thickness monitoring and passive removal of diesel using petroleum traps in Wells PW-13, TRA-1933, and TRA-1934.
- Monitor Voluntary Consent Order investigations of the piping systems at the RTC in relation to observed concentrations of Co-60 in PW-12. This will aid in developing a long-term understanding of the perched water system beneath the RTC.
- Correlate the stratigraphic and lithologic structure of the RTC subsurface with recent geochemical fingerprinting that indicates multiple and distinct sources for the perched water. Developing an enhanced understanding of the perched water bodies might provide additional insight into their influence on contaminant transport at the RTC.
- Continue monitoring perched water and groundwater wells according to the existing groundwater monitoring plan (DOE-ID 2004).
- Monitoring and corrective actions should be implemented until invasive weed species have been eradicated and native vegetation has been restored to 70% of natural conditions. Monitoring and corrective actions should be performed in accordance with the requirements in the OU 2-13 operations and maintenance plan (DOE-ID 2000b) and the *Balance of INL Cleanup Integrated Weed Management Plan* (ICP 2005).
- Revise operations and maintenance activities. For example, the frequency of radiological surveys at the sewage leach pond may be reduced from once a year to once every five years, based on the findings over the past years. Modifications to operations and maintenance activities will require agency approval.

5.8 Protectiveness Statement

Based on the data reviewed and the site inspections, the remedies are functioning as intended by the OU 2-13 ROD (DOE-ID 1997b) and as modified by the ESD (DOE-ID 2000a). No changes in the physical conditions of the sites have occurred that would affect the protectiveness of the remedies. No changes have occurred in the toxicity factors or risk factors for the COCs. Several issues have been identified that warrant further evaluation; however, there is no information that negates the protectiveness of the remedies at this time.

5.9 Section 5 References

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